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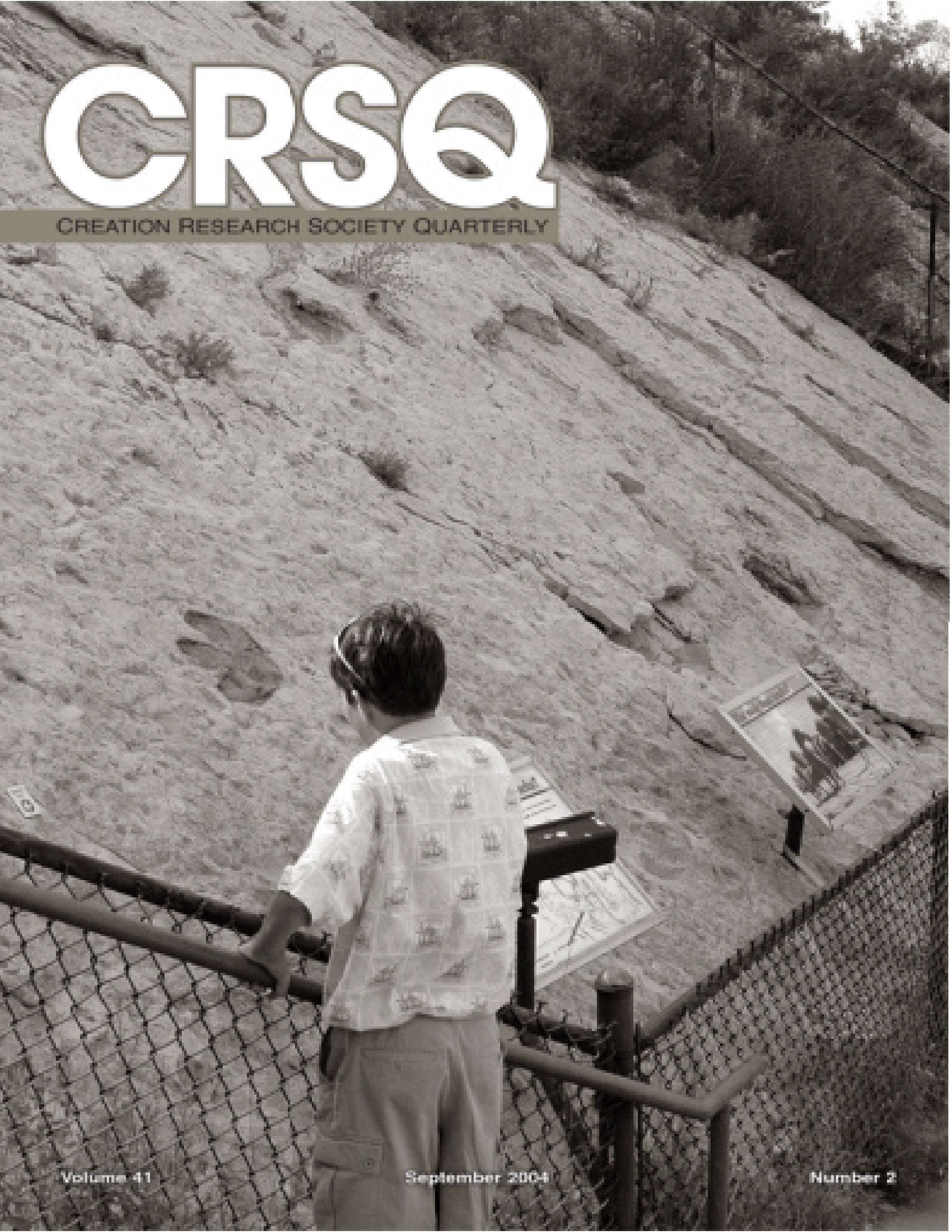

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The photograph on the cover of this issue of the *CRSQ* was taken by Michael Erkel. The site is located very close to Morrison, CO—the namesake of the Morrison deposit. There are noticeable tracks of both ornithopod and theropod dinosaurs in the trackway. There are other exposed slabs farther up and down the ridge that have tracks and worm casings.

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Haec Credimus

For in six days the Lord made heaven and earth, the sea, and all that in them is, and rested on the seventh.—Exodus 20:11

Dinosaur Nests Reinterpreted

Evidence of Eggs Being Laid Directly into Rising Water under Conditions of Stress

Walter R. Barnhart*

Abstract

Supposed nests of dinosaur eggs are examined for indications that they were laid under normal subaerial conditions. It is shown that when representative clutches of eggs are examined from numerous sites worldwide, they were all laid into a watery environment in which sedimentation was often actively taking place. This leads to the conclusion that dinosaur nests, as they are presently found, cannot represent normal living environments for the dinosaurs and instead show life existed at the survival level under highly stressed conditions. These conditions are consistent with egg laying taking place during a worldwide flood.

Introduction

In the effort by creationists to understand the geological record and its relationship to the Flood/post-Flood boundary, no part of the fossil record has created more of a problem than the occurrence of dinosaur eggs throughout strata attributed to the Mesozoic (Garner, 1996, pp. 101–5; Johns, 1997, p. 321; Oard, 1997, pp. 145–6; 1999, p. 4; Robinson, 1998, pp. 61–3). Many questions seem to revolve around rapidly rising Flood waters on the one hand and the apparently slow processes indicated by *in situ* dinosaur egg "nesting" sites. These questions arise because a first look at *in situ* "nests" of dinosaur eggs leads to the assumption that their occurrence must represent significant periods of time without attendant wave action from the global Flood. This time could vary from days to months for the needed nest building, incubation of the eggs, and attendant "brooding" by the parent dinosaur as well as the postulated rearing of young in the nesting location. This has caused some authors to feel that the apparent time period implied by such *in situ* nests must have occurred either prior to the Flood or after it, and therefore they consign these strata and those above or below them to the pre- or post-Flood period.

In this paper I take a second look at these nest structures and the attendant evidence, attempting to determine if the eggs were deposited on existing soil horizons in a normal life cycle period of the parent, or if the eggs were laid on the accreting ground surface during existing Flood conditions (even if that ground was concurrently covered with a shallow layer of water). If the eggs were laid into a watery environment, this would demonstrate that the gravid females were laying eggs under abnormal, highly stressed conditions which might be typical of the Noahic Flood. Such conditions would compel immediate abandonment and preclude any post-depositional manipulation of the egg clutches, or "brooding" by the female dinosaur parent.

A Brief History

Dinosaur eggs are found in abundance in several locations around the world. The first to be noted were in France in 1859 and again in 1869 (Buffetaut and LeLoeuff, 1994, pp. 31–32). Popular knowledge of the occurrence of dinosaur eggs came about through the discoveries made in 1923 by the American Museum of Natural History on their expedition to Mongolia. This discovery also popularized the image we have of dinosaur egg nests (see Figure 1). In more recent years, additional finds in these two locations, plus significant finds in Romania (Grigorescu, et al., 1994), India (Sahni, et al., 1994), Argentina (Oard, 1999, p. 3), Uruguay (Faccio, 1994), and the Rocky Mountains of North America (Hirsch, 1994) have added substantially to the data available for research. In these locations, the eggs have appeared in clutches of several different configura-

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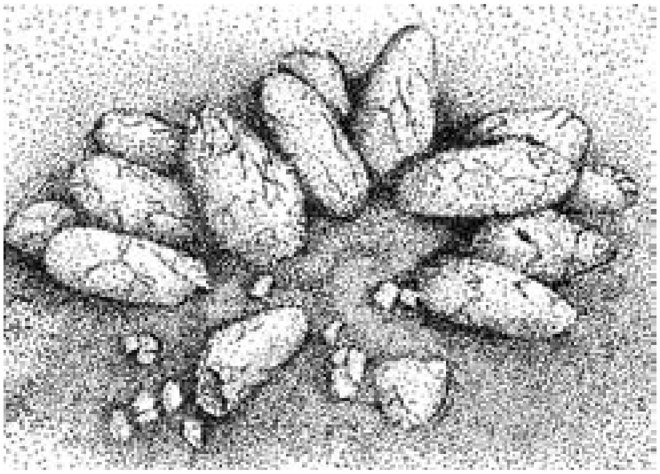

Figure 1. ***Protoceratops(?)*** **egg nest from Mongolia, inverted as prepared and displayed. (Redrawn from drawing, Moratalla and Powell, 1994, p. 42, Figure 3.8).**

tions, often referred to in the literature as "nests," but also singly and as scattered shell fragments distributed locally over large regions. One egg with embryo was even found inside the skeletal remains of a hadrasaur (Hirsch 1994, p. 138), while another egg with an embryonic ornithischian dinosaur was found preserved in fully marine conditions of the chalk in Alabama. It is theorized that the egg dropped from the 'bloated and floating body of a gravid female' (Ensign, 2002, p. 8).

The mere occurrence of eggs is assumed to show that all dinosaurs were oviparous (Paul, 1994, p. 247). Among modern reptiles, both oviparity and viviparity are known (Packard, et al., 1997, p. 75). Some evidence will be mentioned which suggests the same was true in the dinosaurs. (Ovoviviparity in the dinosaurs is beyond the scope of this paper and will be taken up another time.) Among fossil reptiles, the ichthyosaurs are recognized as being viviparous and it is necessary to consider that embryo development may have been already well underway when some dinosaur eggs were deposited.

Types of Nests

Dinosaur egg clusters occur in several arrangements which have been termed nests. Mikhailov, et al. (1994, p. 110) note,

> Three basic modes of nesting can be distinguished from the dinosaur egg sites in Mongolia: a typical underground (hole) nest . . . and two types of mound nests, where the nest is built out of sand or vegetation.

By contrast, Moratalla and Powell (1994, p. 38) identify worldwide,

> . . . two main types: clutched (nest) and linear. Moreover, the clutched type can be subdivided on the basis of how the eggs were distributed into concentric circles, spirals or inverted cones. The linear type also occur in different patterns of parallel rows or arcs.

From Mongolia, the mound nests are presumed to have been

> . . .made of vegetation, then after burial and decay of the nest material the eggs would fall over and the pressure of the overlying sediment would flatten each egg perpendicularly to its long axis (Mikhailov, et al., 1994, p. 111).

This implies burial possibly after hatching but certainly prior to decomposition of the vegetation and crushing of the eggs, although compaction of the vegetation and crushing of the egg in the vertical position seems more likely. The nests called sand nests, by contrast, presume the eggs were laid so as to be supported in a vertical position by the sand and therefore preserved in a vertical or subvertical position (Mikhailov, et al., 1994, p. 112).

There is considerable disagreement concerning the dinosaurs' ability to attain the complex, regular, geometric arrangements found in egg clutches. Mikhailov, et al. admit, "It is not believed that the female manipulated the eggs into position" (1994, p. 111). Speaking of clutches containing several concentric circles of subvertical eggs alternating with a covering of soil around the mounds, however, Moratalla and Powell state that a pattern of two parallel linear rows of eggs ". . . suggests that the eggs were rearranged by the female after egg laying" (1994, p. 41). Based on the common occurrence of regular geometric arrangements of eggs, they suggest that these animals had the capability for recognizing geometrical patterns (Moratalla and Powell, 1994, p. 44). This is not a presumption based on any extant reptile. Yet the regular, geometric patterns do exist, so the *a priori* speculation is that the dinosaur manipulated the eggs on a dry substrate to attain these patterns.

Evidence from Amniotic Eggs

The amniotic egg is thought to have freed tetrapods from having to reproduce in water by protecting the developing embryo from desiccation in a subaerial environment (Carpenter, et al., 1994, p. 4).With the description of dinosaur eggs as amniotic, however, we are identifying them as air breathing organisms. Dinosaur eggs studied by electron scanning micrography have shown varied pore systems which provided gas exchange rates with the environment which vary from eight times the gas exchange rate of bird eggs up to hundreds of times greater (Faccio, 1994, p. 52). This high gas exchange rate is presumed to be necessary for the rapid growth rate suggested for dinosaur embryos,

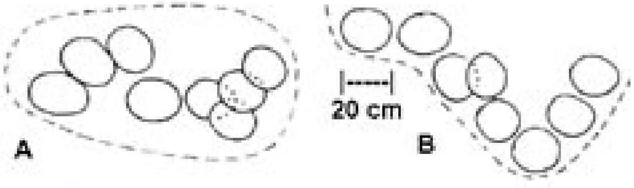

Figure 2. The first clutch of eggs from Rousset, France, to be drawn as a nest by Kérourio in 1981. A. Plan view. B. Vertical section. (Redrawn from diagram, Cousin, *et al.*, 1994, p. 69).

however it would also make the embryo highly susceptible to drowning if the egg is submerged in water. Even a few minutes of submerging a chicken egg will drown the embryo, and it would be reasonable to assume the same to be true for dinosaur eggs. Indeed, it is likely the pattern of breakage found in the shells of dinosaur eggs was the result of a literal explosion of the shell caused by increasing internal hydrostatic pressure as they rapidly absorbed water. This water absorption would drown the embryo.

Evidence that Dinosaurs Were under Stress while Laying Eggs

The occurrence of dinosaur egg clutches in nests are based on two popular images: Figure 1 is the popularly displayed clutch of *Protoceratops(?)* eggs found in Mongolia in 1923, and Figure 2 is a nest of titanosaur eggs found north of Rousset-sur-Arc, France, in 1981. The careful researcher looks beyond the popular images of nests as presented for the general public and past the physical arrangement of what is seen as he makes an effort to understand what was happening at the time the eggs were being deposited. This understanding will allow speculation as to what the conditions were when the gravid female laid her eggs.

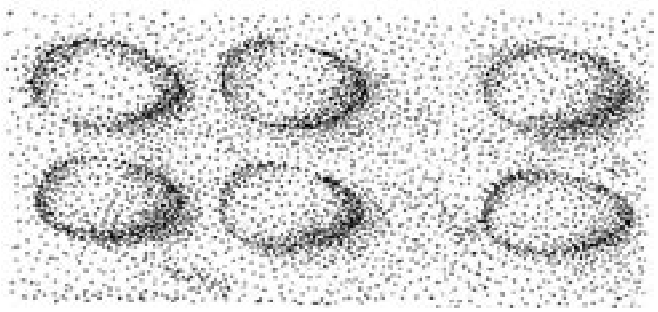

Figure 3. Theropod eggs deposited in two parallel rows, from Montana, United States. (Redrawn from diagram, Moratalla and Powell, 1994, p. 41. Figure 3.7).

From Montana's Two Medicine Formation in a greenish-grey mudstone with occasionally abundant caliche Horner and Currie (1994, p. 312, as cited in Moratalla and Powell, 1994, p. 41) labeled as a nest, the linear pattern of *Troodon(?)* eggs found in two parallel rows, as shown in Figure 3. Pairing of eggs in nests is relatively common and can be seen in several examples including clutches of Protoceratopsidae from Mongolia (see Figure 4). Mikhailov, et al. note, The eggs are often preserved in pairs, possibly as a result of the simultaneous action of both oviducts and the gluing together of the eggs with a mucous secretion (1994, p. 99).

But in referring to the clutch in Figure 3, Moratalla and Powell say, "This pattern suggests that the eggs were rearranged by the female after egg laying" (1994, p. 41). Part of their reasoning for attributing the eggs to theropods is that the shortened forelimbs could be suitable for egg maneuvering.

Does a regular pattern of eggs indicate dinosaur manipulation? A look at Figure 3 with the greater but uniform gap between the pairs of eggs on the right suggests that the eggs were merely dropped, not manipulated. The even distance between pairs of eggs suggests a mechanical determination consistent with their exiting the oviducts in pairs. The mechanical nature of the layout is emphasized by Mikhailov, et al. (1994, p. 99) when they state concerning the eggs of Mongolia, "The eggs are often preserved in pairs, possibly as a result of the simultaneous action of both oviducts and the gluing together of the eggs with a mucous secretion." Paired eggs would then be a sign of stress on the gravid female which resulted in her effort to rid herself of the encumbering

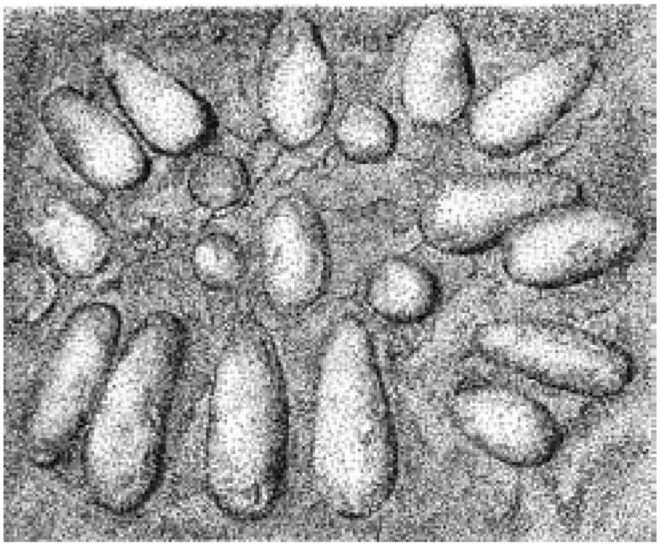

Figure 4. Protoceratopsid eggs from Mongolia. (Redrawn from photo, Mikhailov, et al., 1994, p. 102. Figure 7.12A).

eggs as rapidly as possible. The eggs would not have been manipulated into this pattern, but instead simply fell and were allowed to remain where they fell in the linear pattern as she continued moving forward laying the eggs.

No example of simultaneous function of both oviducts can be found in extant reptiles. The reptile which lays the most eggs in a single clutch is the green sea turtle which lays over 200 round eggs into the same excavated sand nest. While on the beach, the female turtle is subject to predation, yet it deposits its eggs one at a time. Because the eggs are round and the cloaca appears fairly loose, it may be possible that two eggs could exit together, but they have never been observed to do so. The design is restricted to one round egg pushing its way through the canal at a time.

All known birds follow the same pattern, and the design of the tapered bird egg allows the smaller end to push its way through the cloaca first, expanding the opening as gently as possible for the larger, more voluminous end. Working from the pattern of extant reptiles and birds to reconstruct the design of the dinosaurs' soft tissue would lead to the conclusion that dinosaurs exhibited no significant difference in design. This comparison is reinforced because all dinosaur eggs believed to have been laid in pairs are elongated eggs, tapered towards one end, designed to function in the same way as bird eggs, opening the cloaca as gently as possible. Further, it is reasonable to speculate that the laying of two eggs simultaneously may have been an indication of injury which permitted or even caused it to take place.

Multiple Nests Attributed to Different Years May Belong to the Same Clutch

Figure 5 shows three eggs from Lérida, Spain, with the rock surface splitting through the presumed equator of two eggs (based on the size of the eggs) and the top or bottom of a third egg I have labeled number 1. The eggs are attributed to a titanosaur, a Sauropod, and the larger one measures about 24 cm by 29 cm. In the photograph, the rock surface gives every indication of being a cleavage plane and therefore, as demonstrated by Julien, et al. (1998, p. 220), a surface of deposition delineated by a change between fine and coarse sand, the end of one pulse of sediment. The original photograph showed three ovals of white egg shell in a dark matrix of stone. In the photograph it is not possible to tell if egg 1 is above or below the level of eggs 2 and 3. Because its elevation overlaps eggs 2 and 3 by approximately half of their circumference, the overlapping distance would be approximately the same for either situation. For this evaluation, I will assume egg 1 is below eggs 2 and 3.

Considering the eggs in light of the possible sequence of events which occurred during their laying (Figure 6), egg 1 was laid and prior to the time eggs 2 and 3 were laid, approximately 12 to 15 cm of sediment, (half the diameter of egg 1), were deposited. Moratalla and Powell (1994, pp. 41, 45) suggest that when different layers of eggs are present, they may have belonged to different years with an annual return to the nesting site. That would indicate the first egg laid remained on the ground half exposed, yet unbroken, for a full season while the 12 to 15 cm of sand washed in around the egg. For the first egg laid to remain whole and in a position for it to have been cleaved in this manner with eggs 2 and 3, however, it would have needed to be totally buried in its own layer of sediment. It is unreasonable to assume it might have lain half exposed at the surface of the ground for a full year and survived unbroken during the ovipositing of eggs 2 and 3.

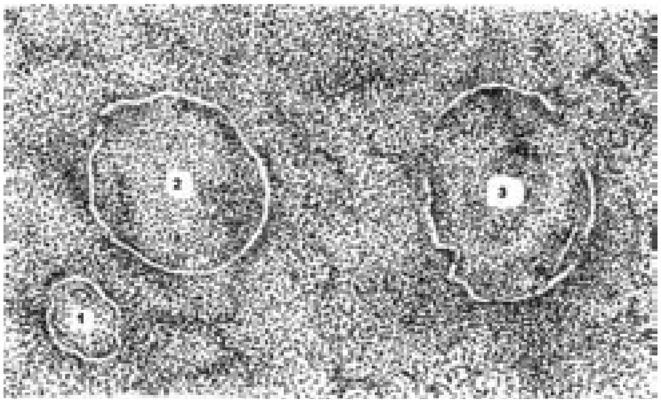

Figure 5. Cross section of Titanosaur eggs as exposed on cleavage plain. Right egg approximately 24 x 29 cm. (Redrawn from photograph, Moratalla and Powell, 1994, p. 40, Figure 3.4).

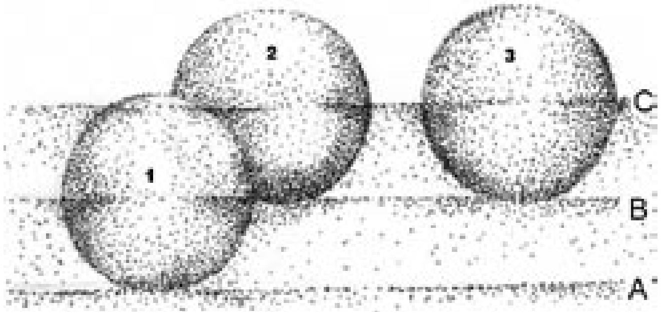

Figure 6. My own sketch showing projected elevation of eggs in Figure 5 with suggested sediment surfaces at the time the eggs were oviposited. Surface A at the bottom was sediment top when egg 1 was laid. Surface B (middle surface) at 12–15 cm higher than A was sediment top when eggs 2 and 3 were laid. Surface C (top surface) is the cleavage plain across which eggs are exposed in Figure 5.

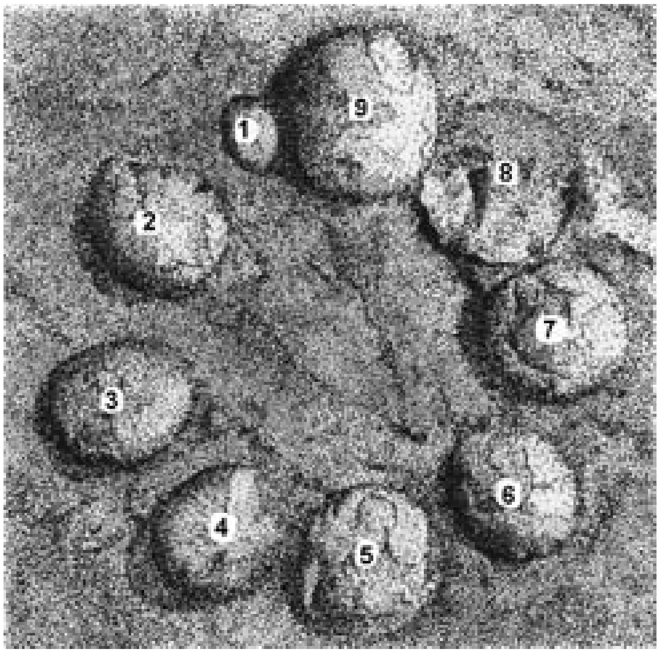

Figure 7. Clutch of *Spherolithus chiongchiungtingensis* from Laiyang, China, 8–10 cm by 7–8 cm, spherical and slightly ellipsoid. (Redrawn from photograph, Mikhailov, et al., 1994, p. 96, Figure 7.7B).

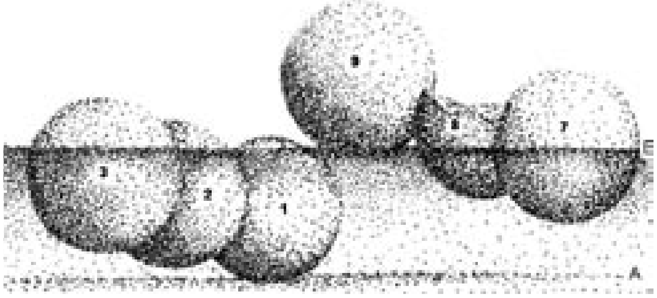

Figure 8. My view of a cross section of a portion of Figure 7 showing eggs in relationship to top of sediment at time egg laying began and ended. Height from the lower surface (A) to surface B would be 5–6 cm to engulf egg 1.

Based on the arrangement of eggs in the photograph, egg 1 was laid along (possibly with an as yet unexposed egg as a pair) into an accumulating sediment, then 10 to 15 cm of sediment accumulated around it while eggs 2 and 3 were clearing the oviduct either singly or as a pair. It is reasonable to assume that the time required for this was a matter of minutes.

A rate of sediment deposition of 10 to 15 cm within a few minutes indicates a significant rate most easily visualized as occurring with moving water covering the nesting site.

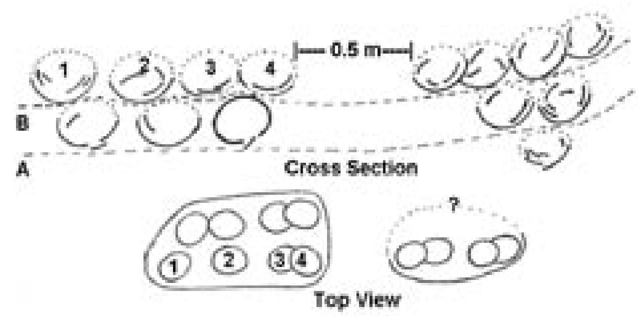

Figure 9. Juxtaposition of two clutches of eggs from Hateg Basin, Romania. Each clutch occurs in two or more separate levels of sediment. Top view shows arrangement of paired eggs to numbers 1–4. (Redrawn from diagram, Grigorescu, et al., 1994, p. 78, Figure 6.4). Note that the numbering of eggs is my own.

Is this trio of titanosaur eggs unusual? Figure 7 shows another example. These eggs from China are significantly smaller, being 7 to 8 cm in diameter. They are believed to belong to a hadrosaur, although no body fossils were found in association (Mikhailov, et al., 1994, p. 99). Here the gravid female seems to have wobbled as she crouched to lay these 9 eggs. While there is no pairing, there is a stair-stepping of the eggs visible around the circle. The laying order appears to be from number 1 to number 9. During the time it took to lay the 9 eggs, 5 to 6 cm of sediment accumulated (Figure 8). This is less than half the accumulation of sediment around the titanosaur eggs, and apparently it occurred over a significantly longer span of time, possibly several minutes. Both examples indicate that the females involved were laying their eggs into moving water of such a depth that it may have covered the eggs completely. This is rather different than the sub-aerial environment which is normally associated with tranquil egg laying.

An even more spectacular example of sedimentation can be seen in Figure 9. These eggs are all about the same size as those in Figure 7, being between 5.6 and 7.5 cm long, as reconstructed. The authors, Grigorescu, et al., (1994, p. 77) comment,

> As indicated by their distribution in the rocks, the subspherical eggs were apparently lying in linear rows, each egg located close to another. The eggs were arranged vertically in two closely superposed levels each containing two groups of two, three or four eggs. The groups were spaced about a half meter from one another. The left and right superposed groups may represent two contemporaneous clutches deposited by the same female or they may belong to two clutches laid in two different years.... On the right

> side, large isolated fragments of another egg were found beneath the first row.

Later excavation revealed four additional eggs in a row, lined up behind eggs 1, 2, 3, 4 in Figure 9. Excavation was not continued to reveal if any other eggs were paired. The pairing of the eggs may be the result of both oviducts working simultaneously, as discussed earlier, and while the female may not have had any control over this action, it would deposit the greatest number of eggs in the shortest time.

Grigorescu, et al. (1994, p. 86) continue:

> The eggs themselves appear to have been buried superficially in fine sandy sediments, which were then rapidly overlain by a thick blanket of coarse sediments.

In a lithographic cross section, the authors show the egg bed as occurring in the upper portion of one meter thick stratified “pinkish, silty marls with calcretes and plant rootlets” grading into “red massive, silty mudstone.... This is sandwiched between a coarse, poorly cemented, grayish sandstone below, and a three meter thick layer of “grayish, poorly cemented cross-bedded conglomerate” (Grigorescu, et al., 1994, p. 77). Although Grigorescu, et al. suggest that the multiple layers may have even been laid down in successive years, they also state as quoted above, … buried superficially … then rapidly overlaid by a thick blanket of coarse sediments (Grigorescu, et al., 1994, p. 86). The stratigraphy suggests that the lower grayish sandstone and the pinkish silty marls may have been deposited by the decreasing velocity of the same wave front. It was in the short span of the ensuing lowered energy waves that the two dinosaurs crouched in near tandem to deposit their eggs. One was slightly earlier than the other and both may have swayed in the current. In the time it took for each to lay her 7 to 8 eggs, or pairs of eggs, 2 or 3 bedding surfaces of sand had collected about their feet and caused the eggs to appear stacked in a “nest” formation. In this instance, the bedding surfaces were retained and the excavators were able to recognize and identify each egg in relationship to the layers. As the wave increased in depth and energy, the females were driven on by the arrival of the conglomerate, an indication of a higher energy wave.

In Figure 10 we see what can only be called a laying field of sauropod eggs. This grouping is from France, but Sahni, et al. (1994, p. 220) give less detailed diagrams of sauropod laying sites in India which he describes as “roughly circular groups,” with one nest site covering about 5000 square meters. In Figure 10 the area covered is about 50 square meters. About half of the eggs lay in arcs of from 1.3 m to 1.7 m in radius. In the description of this site, Cousin, et al. (1994, p. 68) suggest this distance represents the turning radius of the sauropod, and the differences represent different sized individuals. The remaining eggs occur in localized clusters or individually. Figure 11 represents a cross section at FG 11 in Figure 10, where two arcs and a cluster overlap (Cousin, et al., 1994, p. 67). We can see

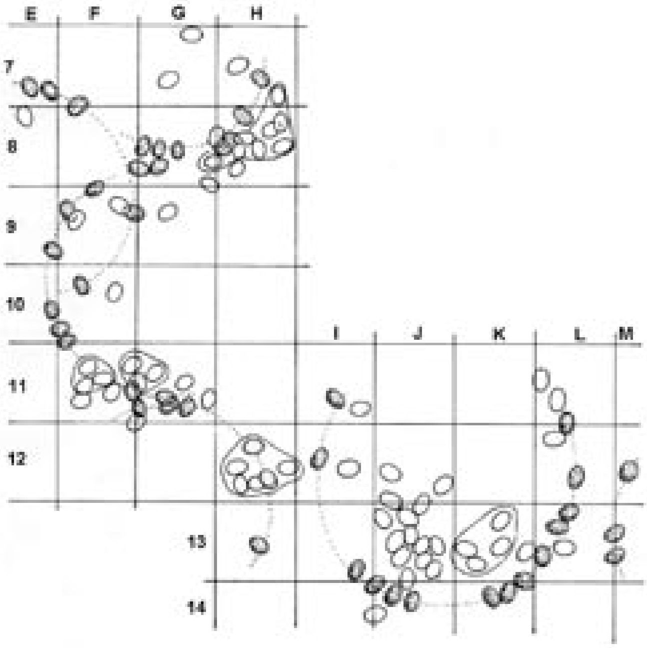

Figure 10. Sauropod eggs from Rennes-Le-Chateau, France. Eggs 15–17 cm x 18–25 cm, arcs 1.3–1.7 meter radius. Shown as originally grouped in nest on 1 meter grid (Watté, et al., 1986; Watté, 1989). All eggs distributed over 35 cm vertically are shown grouped on same plane. (Redrawn from diagram, as cited in Cousin, et al., 1994, p. 71, Figure 5.16).

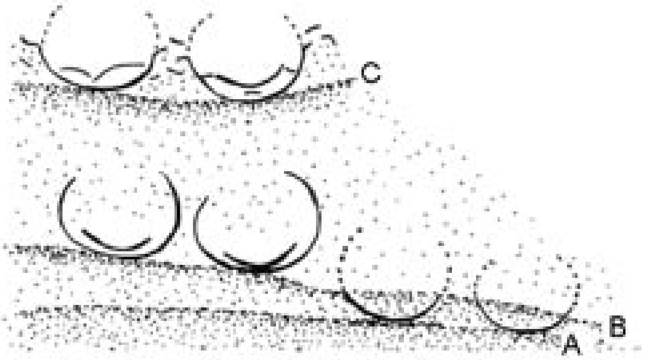

Figure 11. Is this a case of three superimposed egg levels of three separate clutches of eggs, or one clutch laid into accumulating sediment at three different levels of sediment? Cross section through Figure 10 at FG 11. From Rennes-le-Chateau, France. Total height is less than 35 cm. (Redrawn from diagram, Cousin, et al. 1994, p. 72, Figure 5.18, labeling changed).

that the eggs occur on at least three levels within this site. Since all of the eggs are of the same basic sauropod type, Cousin, et al. conclude that those eggs in more distinct clusters and outside the prescribed arcs may belong to a different sauropod species. They suggest *Rhabdodon priscus* for the clumped clusters and *Hypselosaurus priscus* for the arcuate clutches. While the attribution to two separate species of parentage may be possible, no physiological or morphological differences in the eggs are cited, only the depositional difference in pattern.

Figure 11 shows the cluster occurring at the lowest sedimentary level with the two arcs above it. While there is not nearly enough information provided to know if this type of arrangement is generally true, it may be an indication of increasing stress during the egg-laying episode. All of the eggs may have been laid by the same species, with those members of the herd which arrived first being able to pause in one place to drop their eggs. There may have been no standing water on the ground at that time and only a shallow, firmer mud as suggested by the lowest level of eggs in Figure 11, which may have been laid into a very thin layer of sediment. But as one group of females finished or were frightened onward in their escape from the Flood waters, the next group moved into the region as water began to flow across the ground. The middle layer of eggs appears to be deposited into an accumulating mud. The arcuate pattern shows no preferential direction and might represent females entering the location from diverse directions or in pronounced agitation. This agitation may be the direct cause of the arcs. The females were too stressed to stand still and instinctively swung around to view approaching trouble or respond to wave noise.

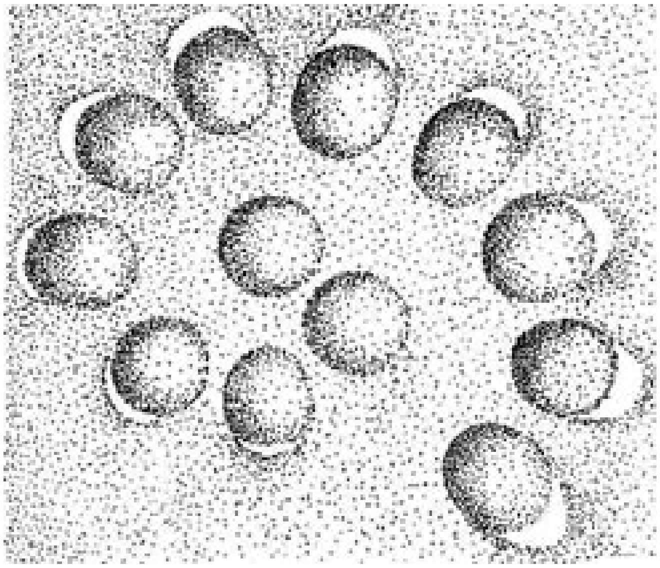

Figure 12. *Orodromeus* eggs from Montana, United States. Clutch of eggs all tilted toward a common point above center egg. (Redrawn from drawing, Moratalla and Powell, 1994, p. 44, Figure 3.11).

Further Evidence Eggs Were Laid in Wet Mud of Rising Waters

If Figure 4 is compared to the very orderly arrangement of the clutch in Figure 12, attributed to another ornithischen, *Orodromeus*, the spiral nature of Figure 4 can be discerned. The ornithischen eggs of Figure 12 seem to have been emitted from a common point in a constantly varied direction outward with enough force that a firm, viscous mud enveloped each egg independently and "froze" it into the arrangement and direction it was sent. Had either of these clutches been laid onto dry sand, as some have attributed them (Mikhailov, et al., 1994, p. 102), it is hard to imagine enough force to cause them to penetrate the sand and not be crushed. The eggs in Figure 4 do seem to have been laid into ground which was of an uneven viscosity. The eggs in the center are fully buried and seem to be essentially vertical. The eggs in the lower portion of the Figure landed on less viscous ground and were unable to penetrate and therefore fell over. This lowered viscosity might reflect an obstruction below the surface, a change in the character of the cementing agent which was hardening unevenly, or dewatering. Those eggs in the upper and right outer ring appear to have landed in mud adequately viscous to maintain their orientation while not penetrating deeply. There does appear to be some paired orientation of the eggs in this clutch.

Figure 12 is so perfectly arranged, it is difficult to imagine how it could be produced by the simple physical actions

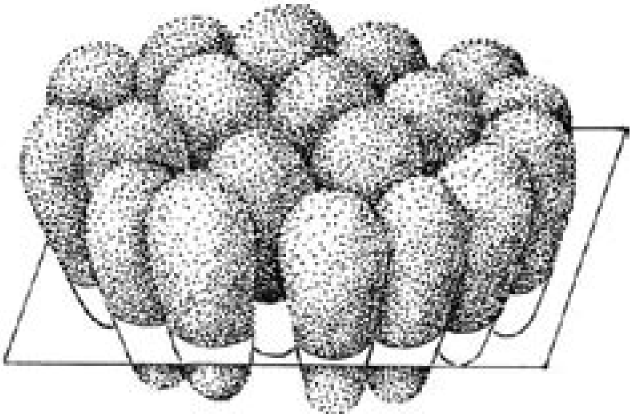

Figure 13. *Elongatodithus* eggs typical clutch structure, large end up, tilted outward. (Redrawn from diagram, Mikhailov, et al., 1994, p. 93, Figure 7.4G).

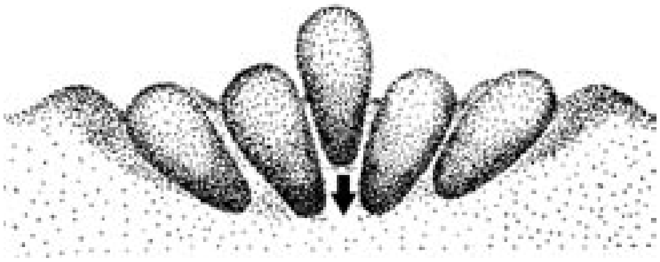

Figure 14. My idea of how elongated eggs would produce a pushed up nest edge as they drop into low viscosity substrate.

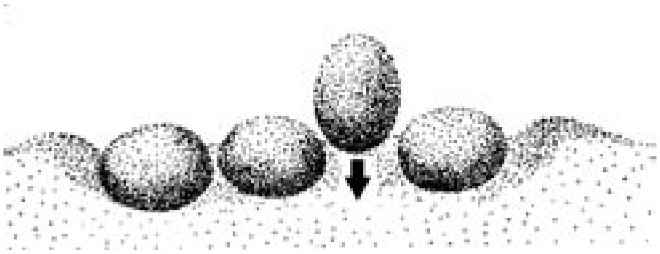

Figure 15. My idea of how subspherical eggs would produce a pushed up nest edge as they drop into low viscosity substrate.

of the gravid female. In fact, some kind of internal anatomy may be necessary to send each egg out of the cloaca in a different direction to produce the spiral pattern. While the mechanism to produce the spiral is elusive, the fact that the orientation is presented seems to be an artifact of being laid into mud, not dry sand.

A second type of vertical or subvertical arrangement of elongated eggs also occurs in Mongolia and elsewhere. These clutches are identified as elongatodithid, and are identified where the top of each egg points outward in different directions (see Figure 13). Here, the description is often of the eggs being arranged in concentric circles (Mikhailov, et al., 1994, p. 113). But the concentricity might simply be an artifact of the random drop of the eggs into a highly viscous mud. While Figures 4 and 12 would be naturally produced if the eggs were laid from a common point but aimed in different directions, the clutch pattern in Figure 13 would take on this outward tilting form if the eggs were laid from a common point directly above the center of the clutch, and the eggs were each allowed to drop straight downward into highly viscous mud (see Figure 14). While the mud in Figures 4 and 12 needed to be thick enough for the implanted eggs to retain their original orientation, the mud in Figure 13 needs to be viscous enough so that as each new egg drops into the center of the clutch it would force the other eggs to float outwards. The smaller diameter on the lower end allowing the same thickness of mud between eggs at the bottom as well as the top, would automatically orient the larger upper end to point outwards. The natural clustering of eggs requiring the least amount of movement during the implanting process would naturally result, arranging the eggs in concentric circles.

The difference of cluster structure between Figures 4 and 13 then would be based on differences of internal structure or maternal motion during deposition and the viscosity of the mud. There would have been differences in the dinosaur species which laid the eggs, especially if one species exhibited a difference in internal body structure which produced the spiral pattern as seen in Figure 12. But it must be emphasized that neither of the two forms of egg clusters would have been preserved with such clarity unless they were deposited in wet mud. Simple covering by sediments after they were laid (see Figures 5, 6 and 9) would not have preserved the specific characteristics of each nest. While wet muds do not automatically require some standing water above the mud, it would preclude the laying of the eggs in a tranquil, dry, subaerial environment and increases the likelihood that these were not normal conditions for dinosaur egg laying.

Oard (1998, PP. 74–76) comments,

> There are only a few nests in the whole world, nests being defined as a bowl-shaped depression around the eggs. One of them is on the top of Egg Mountain (see [his] Figure 1).

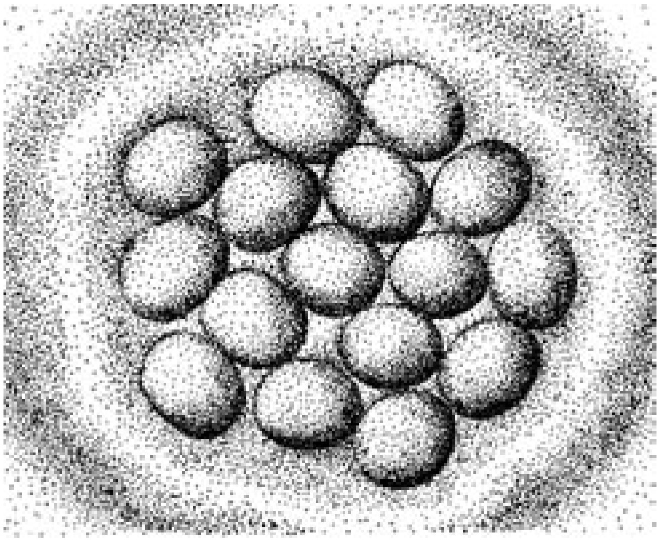

Figure 16. My idea of a subspherical nest as it would look in an aerial view with the nest edge as a natural result of the push-up formed when eggs drop into a low viscosity substrate.

His Figure 1 shows another type of nest, a cluster of eggs surrounded, at least partially, by a ridge of the bedding substrate. If a dinosaur had excavated a depression with its foot and then laid its eggs into the bowl, this is the type of structure that would be expected. But must such a ridge have been produced by excavation? My sketches in Figures 14 and 15 illustrate that such a ridge could have been produced by the dropping of the eggs into a low viscosity substrate. Such a method would produce a cluster which, as Figure 16 shows, would have superficially mimicked the eggs being laid into an excavated depression. The difference would be an excavated nest would have a level cleavage plain under the ridge continuous with the surrounding surface level.. Other indications would need to be examined to determine whether the substrate was viscous or dry when the eggs were oviposited. Several questions remain. Are the eggs on top of the substrate or partially submerged as if floating? Does the ridge form a parting plane with the substrate below? Does the top of the pushup show a continuous texture (a bedding plane cleavage) on its surface with the surrounding stratae?

Evidence from the First Nest Reinterpreted in Terms of a Standing Water Model

The American Museum of Natural History's expedition to Mongolia in 1923 located the first recognized nests of dinosaur eggs (Andrews, 1927). Positioned near skeletal elements of *Protoceratops*, the eggs were assumed to belong to that group and were described by van Straelem in 1925 as *Protoceratops(?) andrewski* (as cited in Moratalla and Powell, 1994, p. 37). Mikhailov, et al. (1994, pp. 110–112) note that the nest was prepared upside down because the eggs always lay with the more pointed end downward. This method produces a much more spectacular museum display as the upper ends of the eggs generally have been crushed or weathered away, and only the lower portion remains. It is assumed that the upper end mostly was destroyed by the hatching window (discussed later). In Figure 1 the bottoms of the eggs . . . are slightly crushed, thus exaggerating their width (Carpenter, et al., 1994, p. 8). The eggs of the nest were identified by Sabath in 1991 as occurring in pairs, a condition thought to be due to both oviducts participating in egg laying (as cited by Carpenter, et al., p. 9).

Figure 17 gives my projected cross section view of the clutch in Figure 1 as it might have appeared when laid. The eggs are inclined with the pointed end outward and generally are thought to have been buried in sand. But the arrangement could have been more easily produced by the dropping of the eggs into a highly viscous sand slurry. The first eggs floated outward and are preserved in a more horizontal position. The final eggs were probably the more vertical ones which were held in this more upright position by the compression created by the more horizontal eggs or decreasing viscosity of the fluidized sand due to dewatering. It would be difficult to imagine the eggs being laid onto dry sand, even soft, dry sand, in such a manner that they were able to become embedded and maintain their final arrangement. Dropping the eggs from a single point onto the top of dry ground might be expected to form a cluster like Figure 18. Additionally, when we compare them to tapered bird eggs, we recognize that the taper could be a design element to keep rolling eggs in an open nest, not buried at all (Figure 19).

The other cluster of eggs to shape the popular concept of dinosaur nests is the one described by Kénourio in 1981 from Rousset-sur-Arc, France (Cousin, et al., 1994, pp.

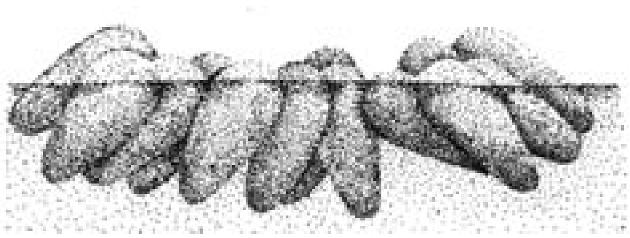

Figure 17. My rendering of *Protoceratops(?)* egg nest from Mongolia, redrawn from Figure 1 to show *in situ* cross sectional arrangement when laid. Appearance is of eggs floating in a high viscosity solution.

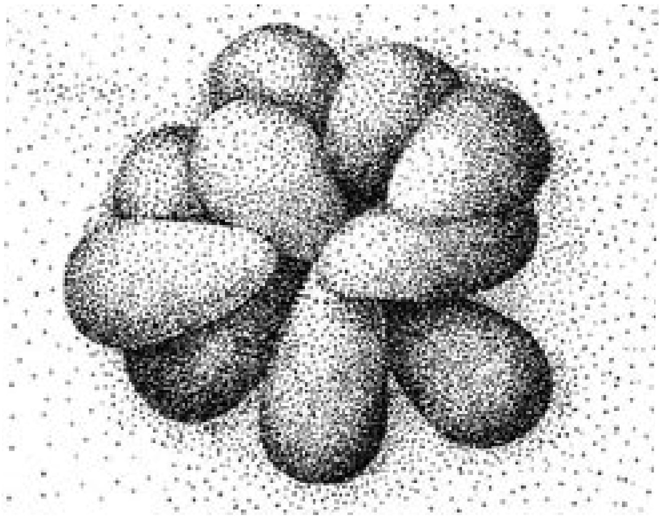

Figure 18. My idea of how the *Protoceratops(?) egg* clutch of Figure 17 might be expected to pile up if laid onto a dry substrate.

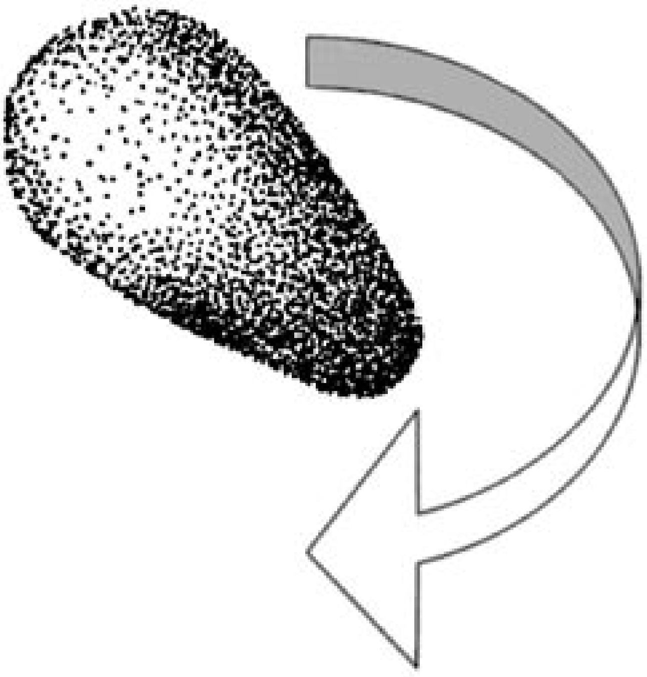

Figure 19. Tapered eggs are designed to encourage them to remain in a nest by rolling around, so as not to require burying.

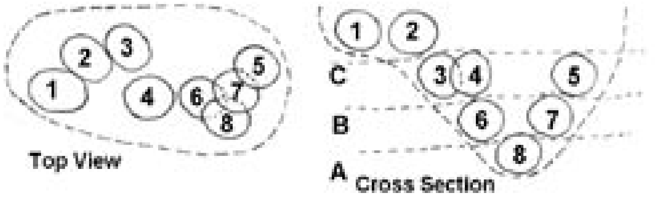

Figure 20. Kérourio's nest drawn to show possible occurrence of eggs in different sediment layers following comments of Cousin, et al. (1994, pp. 63–64). Lettering of possible divisions by layer and numbering of eggs (1–8) is my own.

63–64). He described it as containing 8 eggs which defined a cone 70 cm deep with an upper opening of 70 cm wide by 120 cm long (see Figure 20). Kérourio failed to do any further excavation because the matrix was too hard. He did note a large number of additional isolated eggs. Cousin, et al., themselves, point out that "...the matrix filling the nest cannot be differentiated from the surrounding sediment..." and further propose that the eggs may belong partly to multiple clutches located on different levels. In the cross section (assuming it accurately portrayed what was found) it is possible to draw strata lines between eggs 2 and 3, eggs 5 and 6, and eggs 7 and 8. This could place them into a situation exactly like what was observed in the clusters of eggs from Romania in Figure 9. Or they could be part of a larger grouping as seen in the arcs of Figure 10 and accentuated by the small cross-section taken from it in Figure 11. In this possibility, the large number of additional isolated eggs might indicate that the eggs lying on four different levels define four arcuate rows. The comments of Cousin, et al., taken at face value, would suggest that the nest excavated and illustrated by Kérourio has no characteristics to define it as a single clutch of eggs, and therefore this widely cited example of a nest lacks any characteristics to define it as a nest except the limited excavation of the site. At best the nest should be considered an artifact of the excavation and at worst a case of the paleontologist selecting his fossils to supply support for his preconceived ideas.

Evidence for Stress Conditions Shown by Broken Eggs

In searches for dinosaur eggs, it is extremely rare, if ever, that a completely unbroken egg is located. The shells of most eggs are extremely fractured and spacially displaced. While many eggs exhibit *in situ* fragmentation, intrastratal reworking due to dewatering, and soft sediment deformation, some fragmentation is of such a regular pattern that it raises questions as to its cause.

A careful examination of Figure 9 reveals a regular pattern of breakage. The diagram appears to be done carefully, and the tops of all eggs except one are open. The majority of the displaced pieces inside the lower shell are lying with the concave surface upwards.

Much is made in the literature of "hatching windows" occurring in buried eggs. Almost any time the top of the egg is broken and displaced, it is assumed that the hatchling moved the hatching window when emerging from the egg. This is used as an indication that the eggs lay there in that position long enough for the embryo to develop, emerge from the egg, and desert the nesting site. It is the prolonged span of time for these events which is the crux of the questions about dinosaur eggs and a rapid Flood burial. Because reptile eggs must remain in the same orientation during their entire period of incubation for the young to emerge alive, it is considered unlikely that they could have been transported and still have hatched.

While "hatching windows" do not occur in all clutches of eggs (see Figures 4, 7 and 12 for clutches without "hatching windows"), they often do occur and when they do, they occur in most eggs of the clutch. The occasional egg in a clutch which does not contain a "hatching window" is re-

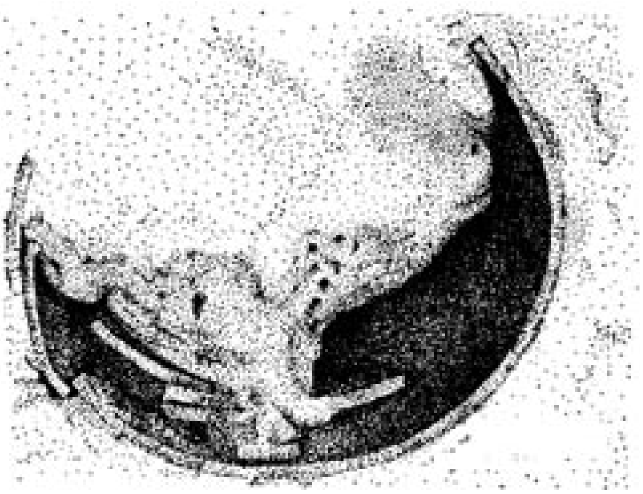

Figure 21. One of cluster of eggs ascribed to Sauropoda, based on large size, from Soriano, Uruguay (redrawn from photograph, Faccio, 1994, p. 49, Figure 4.2,C).

ferred to as infertile. Cousin, et al. (1994, p. 63) conclude, concerning the egg sites in France, the presence of eggs presupposes the presence of beasts, and the presence of beasts presupposes the presence of fertile eggs. Furthermore, they . . . suggest that the hole in the egg is the 'hatching window,' which would indicate that the egg had hatched.

The "hatching windows" most often occur in the top of eggs but may be found on a side or even on the bottom. Openings vary in size from very small to more than the top half of the egg shell. Furthermore, often the piece of shell which came out of the "hatching window" is preserved in the bottom of the shell with its concave surface oriented upwards.

Figure 21, showing a titanosaurid egg from Uruguay, is an unusually clear example. Faccio (1994, p. 48) describes the site: The top of the eggs are [*sic*] broken, while the lower portions are well preserved. The fragments were situated with their internal (concave) surfaces facing upwards.

Eggs Probably Opened while Full of Yoke and Albumen

When the concave surface of the displaced shell faces upward, it would seem to preclude breaking being associated with the hatching of an embryo. Had the embryo hatched at full term the young dinosaur would have filled the shell. When a hatching window was created, the shell would have fallen outward because there would have been no room inside the egg. Once the young had exited the egg, then parts of the shell might have collapsed back into the base of the egg due to attaching membranes, but these pieces would have experienced a random chance of falling concave or convex side upwards. Only when the egg is still full of liquid, not embryo, would pieces of shell float downward in a concave side upward preferential direction. This gives strong reason to believe that the breaking open of the eggshells happened while they were still full of yoke and albumen rather than a developed embryo. Under these circumstances, breakage could have been caused by physical or environmental forces such as pedogenesis or dewatering and the subsequent compression of the sedimentary layers rather than the hatching of young.

Hatching Windows May Be in Bottoms of Broken Eggs

When a portion of the eggshell is left intact, it is most likely the geographic bottom of the shell. While this is most often taken to be a byproduct of the "hatching window" occurring in the upper portion of the shell, it is equally possible that the mud into which the egg was deposited dewatered rapidly or even paracontemporaneous cementation may have begun. Either of these might have provided preferential support to the lower section. When subsequent dewatering began from the weight of the ongoing sedimentary overburden, a disproportionately high pressure on the top of the egg which was not yet supported by a lithofied matrix would thus result in a more common crushing of the top of the egg.

In examining Figure 9 and the pattern of breakage, we see that the bottoms of all eggshells are essentially intact except for eggs 3 and 4. It is noteworthy that the one wholly intact egg (deemed infertile by some) occurs directly below eggs 3 and 4. Two conclusions can be drawn if eggs 3 and 4 broke in preference to the egg below them: 1) All eggs were laid at the same time as it is unlikely that an egg from a previous laying season would have retained greater strength to preferentially break two new eggs, and 2) If the breaks in the bottoms of eggs 3 and 4 and the lack of a break in the egg below them are not related to the hatching of young, then it is unlikely that any of the eggshell breaks are due to hatching of young.

Other Stress Conditions Causing Shell Breakage

The spherical shape of a calcareous egg shell is known for its remarkable strength and might successfully resist crushing by strong compression forces when they are distributed equally over its surface. Therefore, the original breaking of the shells may not have been caused by the dewatering of the substrate, but rather by absorption of water from the substrate.

Among extant reptiles, the crocodilian egg shell is known to be porous, allowing gases to diffuse freely between the enclosed embryo and the external environment. This is required to supply the needed oxygen for development. But along with the oxygen, a crocodilian egg also absorbs water which causes the leathery membrane to swell during the progress of normal incubation (Packard, et al., 1977, pp. 72–3). This same swelling is observed in the Chelonia (sea turtles) and Squamata (lizards) (Packard, et al., 1977, pp. 74–5). It is very pronounced in the American alligator, whose calcareous egg shells have been observed to be cracked when the nest was opened six weeks following oviposition. The same cracks were observed to be expanded two weeks later (Packard, et al., 1977, p 77). Water intake is observed to take place in a wide variety of reptile eggs for up to 14 days, whether the eggs are fertile or not. After that, such uptake continues only in fertile eggs. Intake of water appears to be directly related to osmotic pressure as the rate increases with the temperature of the egg resulting from metabolic processes or substrate changes (Packard, et al., 1977, p. 79).

Many dinosaur eggs have a gas conductance value much higher than crocodilian eggs. If alligator eggs swell to the point of cracking their calcareous shells, it is reasonable to assume that dinosaur eggs would do the same but even faster. Figure 22 shows an egg from Jabalpur, India, which Sahni, et al. (1994, p. 221) report is of similar condition to all eggs at that site. As this egg appears to be of the same type as more solid eggs found in France and Uruguay, with a diameter of 18 to 20 cm, it is likely that it has expanded 2 to 8 cm in diameter. If the membrane swelled that much, then intense fracturing of the shell would result. Where less swelling took place, less fracturing (similar to Figure 9) of the shell would result. Intense fracturing of the shell might be an indication of high water temperature in the eggs of India which are all directly associated with the Deccan Basalts.

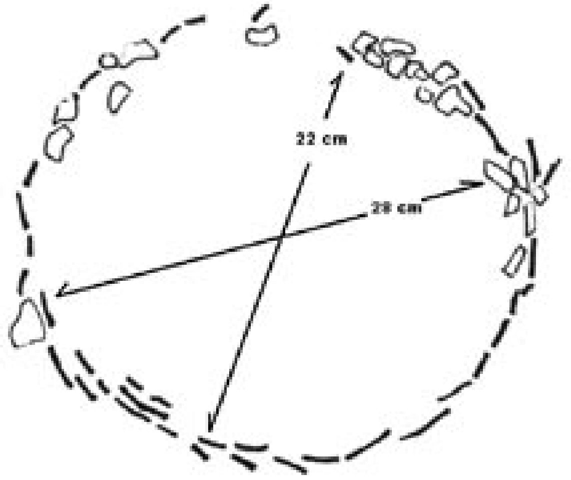

Figure 22. Titanosaurid egg, Jabalpur, India. Normally 18–20 cm diameter, *in situ* fragmentation typical of all eggs this locale. (Redrawn from drawing, Sahni, et al., 1994, p. 221, Figure 13.15).

Evidence of Stress Conditions from Scripture

The Hebrew term *mabbul* is used exclusively to refer to the Noahic Flood in Genesis, except for one use by King David in Psalm 29:10, "The Lord sitteth upon the flood." This has caused some to consider that the actions described previously in that psalm are a result of not just any flood, but the Noahic Flood. In this regard, the phrase, "He maketh the hines to calve" in verse 9 (KJV) has given translators some difficulty. (The New International Version translates it, "He twists the oaks.") The word translated "calve" carries the idea of causing it to happen out of season. In the vernacular, that would be referring to a natural abortion. A natural abortion certainly can be induced by stress. While the psalm was referring to a mammal, the occurrence of dinosaur eggs laid into wet sediments might be an example among reptiles of what this verse was citing for the mammal. The gravid female dinosaur retained the eggs in the oviducts because of the lack of a safe location to lay them. Later, in an effort to save her own life in the Flood's wave action, or as a response to the stress, she dropped them at the first contact with firm ground.

Another possibility is that some dinosaurs may have been functionally or at least partially ovoviviparous, normally retaining the eggs in the oviducts until they were partially or completely developed. At the onset of the Flood, some dinosaurs already may have contained eggs which had been developing for considerable time. If this were so, it would account for embryos of varied ages and sizes all the way up to hatchlings occurring in egg shells and associated with regions where broken shells are found. This is a matter for further research.

Concluding Comments

In discussing difficulties with dinosaur eggs and Flood models, Woodmorappe (1996, p. 285) once remarked on the validity of the premise that dinosaurs could not lay eggs under stressful conditions as "…something that we do not know and probably never will know."

By looking carefully at the eggs and their depositional environment, it is possible to determine some of the conditions under which the eggs were laid. In this article I have identified six indicators of dinosaur eggs routinely being laid under conditions of stress.

1. Eggs of the same laying episode are positioned at different levels as though they arrived on top of the sediment as it was being built up actively.
2. Eggs are positioned in the substrate as though their final positions were determined by the viscosity of wet sediments into which they were dropped.
3. Eggs are found arranged in such a way as to suggest that they were allowed to drop in the most expedient manner and then allowed to lie where they landed.
4. Eggs are found with their calcareous shells exploded by the absorption of water as though they were laid into water which was most likely hot.
5. Eggs are found with pieces of hatching windows lying inside the lower portion of the shells, usually with the concave surface upward, indicating breakage by causes other than the hatching of young and also indicating negligent treatment of the eggs when they were laid.
6. Eggs are found at multiple horizons having been laid under stressful conditions and indicating the desperate situation in which the gravid females found themselves.

Not all deposits of dinosaur eggs have been considered, but enough examples have been cited here to provide confidence that a second look will show that clutches were routinely laid under stressful conditions directly into wet sediments, which, in many cases, may have been covered with at least a shallow layer of water at the time.

Acknowledgements

I express thanks to the editorial staff and referees who helped greatly in shaping the text of this paper. A special thanks is extended to my wife for tireless hours transcribing and correcting my scribbles. Without her help this paper would never have been. Any errors are strictly my own. *Be exalted, O God, above the heavens, and thy glory over all the earth.*

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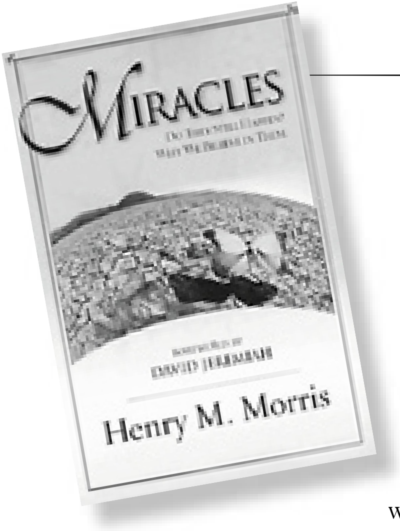

Book Review

Miracles by Henry Morris
Master Books, Green Forest, AR. 2003. 141 pages, $10.00

Dr. Morris explains that this book was motivated by a serious auto accident in which he and his wife were spared injury. Dr. Morris is skeptical of many modern miracles, but he has studied and spoken on the topic. True to his scientific engineering nature, Dr. Morris places miracles into three distinct categories. *Class* A miracles involve a temporary laying aside of either of the two most basic laws of nature, conservation of energy and the dissipation of energy. These are also called the First and Second Laws of Thermodynamics. Class A miracles are performed only by God who established the natural laws in the first place. Examples include the original creation *ex nihilo*, the dividing of the Red Sea (Exodus 14), changing water to wine (John 2), walking on water, the resurrection of Christ, and the new birth conversion experience within human hearts.

In the Morris view, *Grade B* miracles involve the providential ordering and timing of events within natural laws. They also include temporary alterations of natural rates of change. Grade B miracles include the Flood, the earthquake which freed Paul and Silas from prison (Acts 16), and also the avoiding or surviving of a serious accident. It is noticed that Grace B miracles often include the activity of angels and include specific answers to prayer. Dr. Morris suggests that evil angels may also perform B but not A miracles. Apparent A miracle activities by evil forces, as when Pharaoh's men turned wooden staffs into serpents (Exodus 7:8–13), are described as hallucinations or hypnotism (p. 92).

Dr. Morris surveyed all the biblical miracles and concludes that 38% are A category, 55% are godly B, and 7% are demonic B (p. 103). But far greater in occurrence then either A or B are *Grade C* miracles. There are the countless (but no less miraculous) answers to prayer which continue day by day in the lives of millions of believers worldwide (p. 134). The Morris miracle classification is somewhat similar to the distinct "classes" or "senses" of miracles which have been known to theologians since Augustine. A review of the traditional categories of miracles would have been helpful.

Dr. Morris expresses uncertainty in categorizing real, contemporary physical healings, whether in the A or B category. He describes modern "tongues speaking" as probably psychological and not at all miraculous (p. 53). Challenging political correctness, Dr. Morris describes the words of Islamic prophet Mohammed as demonically inspired (p. 83). This book describes many personal experiences of the Morris family. Dr. Morris has once again given his unique insights to an important topic, in this case miracles. His clear discussion will be helpful to many readers. Subject and scripture indexes are provided.

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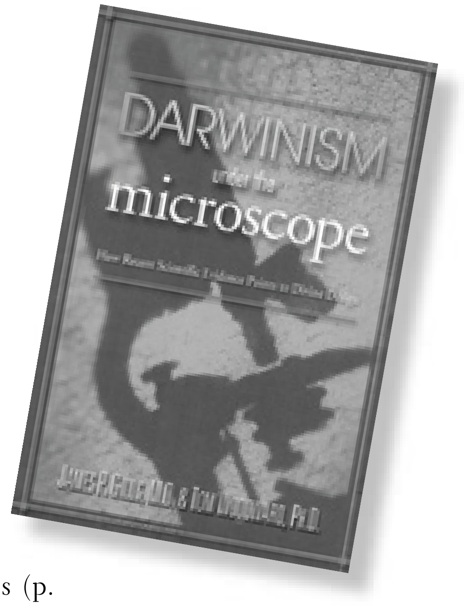
Book Review

Darwinism Under the Microscope:
How Recent Scientific Evidence Points to Divine Design

by James P. Gills and Thomas E. Woodward
Charisma House (Strang Communications Co.), Lake Mary, FL 32746.
2002. 236 pages, $14.00


DARWINISM
under the
microscope
How Recent Scientific Evidence Points to Divine Design
James P. Gills, M.D. & Tom Woodward, Ph.D.

In recent years the intelligent design (ID) movement has experienced an explosive expansion with reverberations in education, religion, and science. Accompanying philosophic and scientific ID there has been an anti-Darwinian thrust activating responses from both friends and foes.

This present book (DUTM) is authored by Gills, a world-famous ophthalmologist, and Woodward, who received his Ph.D. in communication from the University of South Florida in 2001. His dissertation topic dealt with the ID movement. The DUTM is a compilation of new articles and some recent reprints by a dozen ID scholars. The list includes Mark Hartwig, Charles B. Thaxton, Phillip E. Johnson, Michael Behe, William A. Dembski, and George Ayoub. The two major parts of the text are titled "The Unraveling of Darwinism" (6 chapters), and "Irreducible Complexity and the Detection of Design" (5 chapters).

There is some overlap of material covered but this is to be expected in a broad treatment of these subjects. However, the main messages come through courageously and clearly. The book commences with short write-ups by R. T. Kendall, R. Swenson, J. P. Gills, and T. E. Woodward (in a Prologue, Foreword and Introduction). At the end of the volume is Appendix A which is a *World Magazine* 2002 reprint by Lynn Vincent entitled "Science vs. Science." This paper captures the main ideas in the entire book. Appendix B is "The Alabama Biology Textbook Disclaimer." This appendix is followed by 14 pages of notes and references for the main chapters of the book. Then follows 10 pages of "Recommended Bibliography," mostly annotated. There is no index.

Information in DUTM should be of value to a wide spectrum of readers. Critics of ID have been denigrating it as a religious idea, but Dembski clearly disagrees calling it a completely empirical scientific conclusion (p. 136) subject to disproof; but ID also may have "theological implications" (p. 132). In Chapter 9 Ayoub affirms that the structure and function of the vertebrate eye strongly supports ID. We learn from Woodward about paleontologist Jun-Yuan Chen's January-2000 exposition regarding exciting discoveries in China, including fossils of many soft-bodied creatures (p. 104). Chen believes that their discoveries in China have disproved Darwinism as an engine of evolution (p.105).

In Chapter 8 Michael Behe answers critics of his views concerning irreducible complexity. William Dembski, a leader of the ID movement, says that we need chance, necessity, *and* design "to explain the full range of scientific phenomena"(p. 170). Many scientists today are resisting ID and its implications. In response, Gills in his concluding chapter presents this condition "as a hesitance to open the eyes and face the deeper truth that obviously shines through the breaks and faults of a thin and fractured surface" (p.191).

DUTM is well edited but there are a few minor matters that can be corrected for the next printing. On pages 182–185 the superscripts are misnumbered. In Note 17 (p. 225) matrix is misspelled. Chapter 2, a reprint from Moody Magazine, could be improved by inclusion of bibliographic information. On page 234 there is no copyright date (only *reprint* date) for Thaxton, et al. In the figure on page 43 the label mitochondrion should be in the singular (not ending with ia). The last line of p. 47 technically should say cell division (cytokinesis) instead of mitosis which is nuclear division.

After reading DUTM I felt overwhelmed by the convincing totality of the compilation. I believe that other readers of this DUTM book also will have their eyes opened, minds expanded, and thinking challenged.

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Evolutionary Explanations for Anomalous Radiocarbon in Coal?

Russell B. Rotta*

Abstract

The simplest explanation for radiocarbon presence in coal is that it was there when the coal formed. Radiocarbon dates of coal are typically 40,000 years, which obviously conflict with typical carboniferous coal geological ages of 300 million years. The viability of various evolutionary motivated explanations for the anomalous radiocarbon ages are considered, and the effects are demonstrated to be several orders of magnitude too small to account for the observed radiocarbon concentrations. The only reasonable explanation is the radiocarbon was incorporated at the time of formation, the geological ages are fictitious and the methodology of the 170 year-old Lyellian geological column is flawed.

Introduction

Evolutionists and those that believe in an ancient earth understand that radiocarbon presence in coal in measurable levels is a problem for the established geological timescale. Indeed, Hunt's (2002) website succinctly states:

> Accelerator mass spectrometry (AMS), a sensitive radiometric dating technique, is in some cases finding trace amounts of radioactive carbon-14 in coal deposits, amounts that seem to indicate an age of around 40,000 years. Though this result is still too old to fit into any young-earth creationist chronology, it would also seem to represent a problem for the established geologic timescale, as conventional thought holds that coal deposits were largely if not entirely formed during the Carboniferous period approximately 300 million years ago. Since the halflife of carbon-14 is 5,730 years, any that was present in the coal at the time of formation should have long since decayed to stable daughter products.

From an evolutionary perspective, the presence of C-14 in coal requires an explanation. One explanation given on the Talk.Origins website is that the C-14 in coal is the result of radioactive decay of the uranium and thorium decay series. Another explanation considered, but the website discounts it as unlikely is the infiltration of modern C-14 into the coal environs that contaminates the "ancient" coal with the new C-14. This "widespread contamination" explanation is also considered unlikely (Hunt, 2002).

The simplest explanation for the presence of the C-14 in coal is that it was there when the coal formed and it was formed recently, on the orders of thousands, not millions of years ago. This paper will show that the levels of natural uranium-thorium radioactivity in coal are not sufficient to generate the amount of C-14 necessary to give the "apparent" C-14 ages of 20,000 to 40,000 years that are typically determined for coal. We will also consider the possibility of contamination of the "ancient" coal by modern C-14 and demonstrate this possibility is untenable.

Question: Can the observed levels of C-14 in coal result from the uranium or thorium decay chains?

To answer this question we will consider these decay chains. Uranium consists of uranium-238 and its progeny, and uranium-235 and its progeny. Natural uranium consists of 99.2745% by weight U-238, 0.720% U-235 and 0.0055% U-234 (Kinsey, 1999). Often, uranium and thorium are near secular equilibrium with their daughters. Secular equilibrium occurs where the parent nuclide has a half-life much greater than any of the progeny and a sufficient time has elapsed for the progeny to build up/decay to near

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the same activity level of the parent. Figure 1 displays one molecular weight (mole) of natural uranium and Figure 2 shows one mole of thorium in secular equilibrium with its progeny.

In the 1980's, new types of radioactivity were discovered involving the emission of C-14, Ne-24, Ne-25, Mg-28 and other nuclei (Greiner and Sandulescu, 1990). It is thought that Ra-223 is the nucleus with the largest probability for emitting a C-14 nucleus, with Ra-226, Ra-224 and Ra-222 also exhibiting measurable radioactivities of this type. They are called cluster radioactivities. Normally, the most stable combination of particles that can be emitted is an alpha particle, the nucleus of helium-4, consisting of two neutrons and two protons. However, the theoretical and experimental efforts of the 1980's showed that other cluster emissions, although rare, do in fact occur. In the case of radium-223, the probable mode of decay is the emission of an alpha particle, but in nearly one out of a billion decays, a carbon-14 nucleus is emitted instead.

Now, C-14 is generated in natural uranium and thorium through the radium-226, radium-223 and radium-224 decays. The branching ratios for these nuclides to form C-14 is very small, for radium-226 it is 3.2 x 10^{-9} %, for radium-223 it is 6.4 x 10^{-8} %, and for radium-224 it is 4.0 x 10^{-9} % (Kinsey, 1999). The equilibrium concentration of C-14 is also displayed in the diagrams for the uranium and thorium decay chains. One mole of uranium is 79.4 microcuries (μCi) U-238, and 3.70 μCi U-235 with various concentrations of the progeny as shown. Note in particular, that one mole of uranium generates an equilibrium concentration of 2.5x10^{-9} μCi C-14 from the U-238 and 2.4x10^{-9} μCi C-14 from the U-235 decay chains for a total of 4.9x10^{-9} μCi C-14. Another way of expressing this is that one gram of uranium in equilibrium with its daughter has 2.1x10^{-5} picocuries (pCi) C-14 per gram of uranium.

Uranium and thorium typically are found in coal at concentrations of 1 to 4 parts-per-million (ppm) with maximum concentrations in United States coals rarely exceeding 20 ppm of either element (USGS, 1997). Can this level of radioactivity in the coal produce anything near the levels of carbon-14 to give radiocarbon ages of 20,000 to 40,000 years? No, because the number of atoms of uranium (N_U) divided by the number of atoms of carbon (N_C) or for the thorium chain must be

$$\frac{N_U}{N_C} = \frac{1}{8.0 \cdot 10^{-17}} \cdot \left(desired \frac{C-14}{C} ratio \right)$$

$$\frac{N_{Th}}{N_C} = \frac{1}{1.6 \cdot 10^{-17}} \cdot \left(desired \frac{C-14}{C} ratio \right)$$

For instance, if the desired C-14/C ratio were 1x10^{-14} (corresponding to 40,000 years), then the coal would need 125 uranium atoms per carbon atom. This "coal" would be 99.96% by weight uranium, which most people would call uranium and not coal. Thus, we need so much uranium or thorium to produce the desired C-14/C ratio, that it is practically impossible for C-14 generated from the uranium or thorium chains to produce the observed C-14 concentrations in coal.

Another possibility is that the C-14 is not primarily produced by the radium decay in the uranium/thorium in the coal, but by the surrounding uranium and thorium deposits. This can be dismissed readily based upon the following consideration:

> Consider a layer of coal of density ρ_{carbon} and thickness d_{carbon}. This is covered by a layer of uranium of density ρ_U and thickness d_U. Making the liberal assumption that all of the uranium series generated C-14 moves immediately to the coal layer, how thick must the uranium layer be in order to sustain the observed C-14/C ratio in the coal layer? Actually, much of the C-14 will never make it to the coal layer and we are making this assumption because it is simple and even with this assumption it demonstrates how difficult it is to produce the observed C-14/C ratios observed in coals. The minimum thickness required is
>
> $$d_U = \frac{1}{8.0 \cdot 10^{-17}} \cdot \frac{\rho_{carbon}}{\rho_U} \cdot \frac{238}{12} \cdot d_{carbon} \left(desired \frac{C-14}{C} ratio \right)$$
>
> where the densities are densities of carbon and uranium, and not the contaminants. For a density of carbon of 1 g/cc, density of 18.95 for uranium, a one-meter thick coal layer and a desired C-14/C ratio of 1x10^{-14} (corresponding to 40,000 years), we get a thickness for the uranium layer of 130 meters of pure uranium metal.

On the basis of the above analysis, we can conclude that C-14 generated from the decay of radium through the uranium or thorium decay chains requires too much uranium or thorium to produce the observed C-14/C ratios. See Table I for the expected C-14/C saturation ratios.

As can be seen in Table I, the calculated ratios in are far below the observed ratios seen in coal.

Could some C-14 be generated from the spontaneous fission of some of the nuclides in the uranium/thorium decay chain? The spontaneous fission rates for the parents and progeny are a fraction of a percent, being 0.00005%, 1.7x10^{-9} %, 7.0 x10^{-9} %, and <1.0 x10^{-9} % for U-238, U-234, U-235 and Th-232, respectively (Kinsey, 1999). Most fissions of uranium produce two unequal fragments with several neutrons. In one out of 200 to 300 fissions, a third

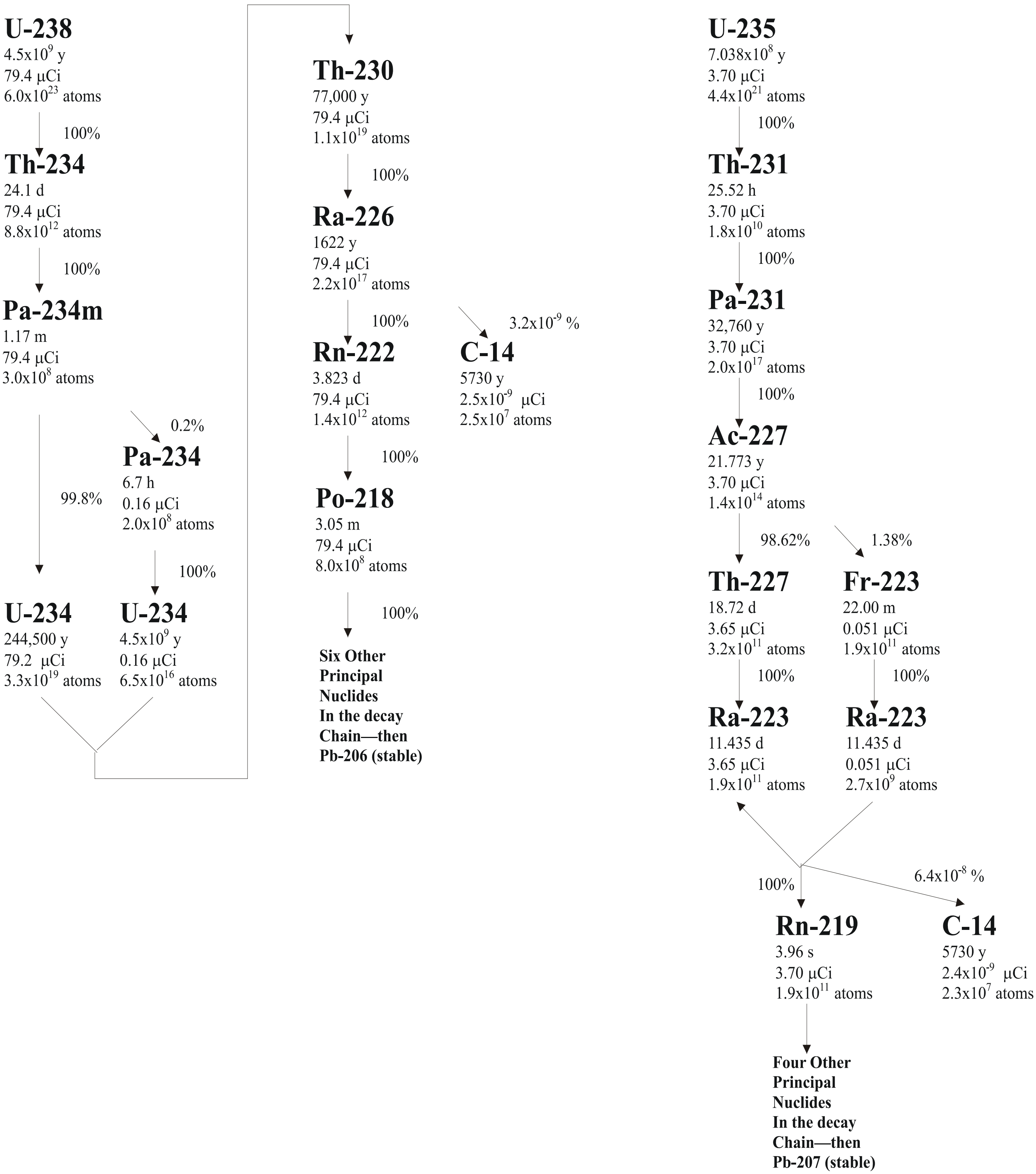

Figure 1. One mole of natural uranium (238.027 g) maintains under secular equilibrium 4.9 billionth of a microcurie of C-14 by the low probablility emission of C-14 nuclei from Ra-226 and Ra-223. This is 48 million atoms of C-14 per mole of uranium that corresponds to a C-14/U ratio of 8x10^{-17}. This diagram does not include the C-14 production by the neutron activation of nitrogen.

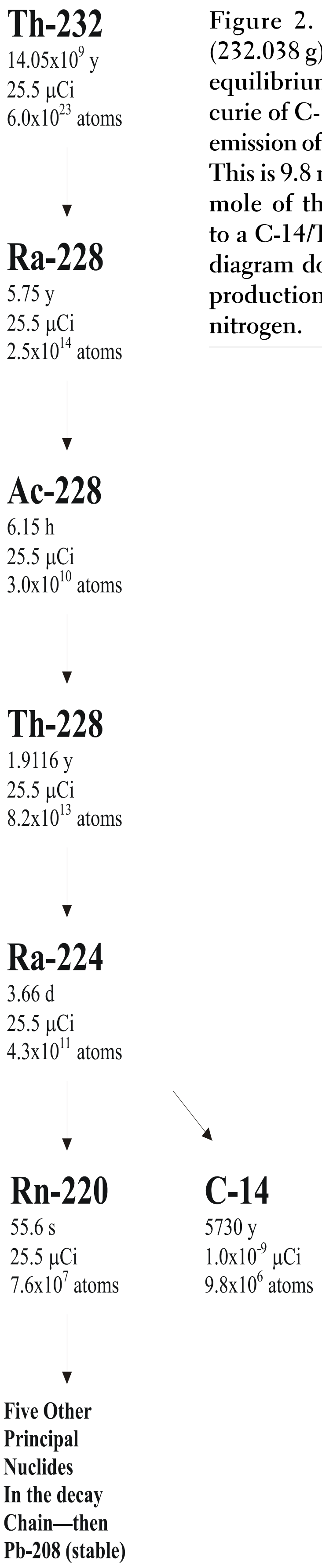

Figure 2. One mole of thorium (232.038 g) maintains under secular equilibrium 1 billionth of a microcurie of C-14 by the low-probability emission of C-14 nuclei from Ra-224. This is 9.8 million atoms of C-14 per mole of thorium that corresponds to a C-14/Th ratio of $1.6x10^{-17}$. This diagram does not include the C-14 production by neutron activation of nitrogen.

Coal Type (% carbon)	Expected C-14/C ratio for 1 ppm U	Expected C-14/C ratio for 1 ppm Th
Anthracite (86–98%)	4.1 to 4.6 x 10^{-24}	8.6 to 9.8 x 10^{-25}
Bituminous (45–86%)	4.6 to 8.9 x 10^{-24}	9.8 to 19 x 10^{-25}
Subbituminous (35–45%)	8.9 to 11 x 10^{-24}	1.9 to 2.4 x 10^{-24}
Lignite (25–35%)	1.1 to 1.6 x 10^{-23}	2.4 to 3.4 x 10^{-24}

Table I. The expected C-14/C ratio for 1 ppm uranium or thorium due to C-14 in equilibrium (best case) with the U or Th decay chains.

Nuclide	Isotopic Abundance	Thermal (0.0253 eV) Neutron Activation Cross Section (barns)
C-13	1.11%	0.001
N-14	99.64%	1.827
0-17	0.039%	0.235

Table II. Isotopic abundances and cross sections for thermal neutron capture (T2 Nuclear Information Service, 2003.

fragment is emitted, a process called ternary fission. The most probable third fragment is an alpha particle, but other particles including C-14 nuclei are also possible. Vorobyov et al. (1972) measured the probability of a C-14 emission for neutron-induced fission of U-235, and found it to be 5.4 ± 0.6 carbon-14 nuclei per 10^4 alpha particles. Hence, the rate is at most $9.3x10^{-8}$ carbon-14 atoms per fission. The production rate for spontaneous fission production of C-14 would be the decay rate multiplied by the probability of spontaneous fission multiplied by the carbon 14 atoms per fission, which is a negligible rate of production.

Could some of the C-14 be generated in the coal be by neutron activation by the C-13(n, γ)C-14, N-14(n, p)C-14 and O-17(n,α)C-14 reactions? Yes, but consider the isotopic abundances and the cross sections for thermal neutron capture are shown in Table II.

If we had one mole of each element in the coal subject to the same thermal neutron flux, the O-17(n,α)C-14 reaction would produce 8.5 times as much C-14 as the C-13(n, γ)C-14 reaction and the N-14(n, p)C-14 reaction would produce 195 times as much. However, coal is primarily carbon so the isotopic fractions of N and O will probably be much less as shown in Table III with information for typical USA hard coal.

As can be seen, nitrogen would produce most of the C-14 via neutron activation. The following is a conservative order of magnitude estimate to determine an upper limit on how much C-14 can be produced in typical USA coals due to uranium in the coal:

Consider a layer of coal of area A and thickness d_c. With the following definitions

ρ_{cm}=density of coal media including noncarbon components (g/cm^3)

f_N=fraction of the weight of the coal media that is nitrogen

Component Element	% Weight	Percent Production Rate of C-14
Carbon	73%	0.03%
Oxygen	7.5%	0.08%
Nitrogen	1.4%	99.89%

Table III. Typical Hard Coal Composition and Percent Production Rate of C-14 by Neutron Activation (Öko-Institut, 1999).

f_U=fraction of the weight of the coal media that is uranium

f_C=fraction of the weight of the coal media that is carbon

f_{sf} = fraction of decays that are spontaneous fissions

A=area of coal layer of interest in cm^2

d_c=thickness of coal layer (cm)

SA_U=specific activity Becquerrels per gram (Bq/g)

$N_{f\text{-}U}$=average number of neutrons per spontaneous fission

the thermal neutron flux is less than

$$\varphi = f_U \rho_{cm} d_c (SA_U) f_{sf} N_{f-U}$$

and the number of target nitrogen atoms is

$$n = f_N \rho_{cm} A d_c \frac{N_A}{W_{M-N}}$$

so that the saturation activity per volume would be less than

$$\frac{\varphi \sigma n}{A d_{cm}} = f_U f_N (\rho_{cm})^2 (SA_U) f_{sf} N_{f-U} \sigma_N d_c \frac{N_A}{W_{M-N}}$$

and so the C-14/C ratio should be

$$\frac{C-14}{C} = \frac{f_U f_N}{f_C} \frac{W_{M-C}}{W_{M-U} W_{M-N}} \rho_{cm} \frac{\tau_{1/2C-14}}{\tau_{1/2U}} f_{sf} N_{f-U} \sigma_N N_A d_c$$

This shows that the saturation C-14/C ratio of the layer could be increased if the product of the fractional weights of uranium and nitrogen can be increased. It must be understood this was derived using a thin layer assumption. If d_c were too large, the thin layer assumption would not apply. If we adhere strictly to the above formula and if we use too large of a value for d_c, we would overestimate the C-14 to C ratio since most of the incident neutron flux would have been removed from the beam by attenuating processes and would not be available for additional activations. Using Figure 7.13 of Shleien, Slaback, and Birky (1998) a reasonable estimate would be $d_c < 25$ cm for a density of 1 g/cm^3 and using this the result for 1 ppm U, 1.4% nitrogen a C-14/C ratio of less than 3.3×10^{-21}. Even substituting in 20 ppm, we only get 6.6×10^{-20}, which is much less than the C-14/C ratio corresponding to 40,000 years. We have concentrated on uranium-induced activation of nitrogen since the fission rate is about 80 times higher than all of its progeny, U-235 progeny and Th-232 progeny. When there is more than one nuclide that undergoes spontaneous fission, then sum over U for the various nuclides.

The above analysis has been for neutron activation due to U/Th dispersed within the coal. For neutron activation of the coal from outside, the neutron activation would be expected to penetrate only about 25 to 50 cm of the coal.

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Decay Chain	Radium Generated C-14 Emission	Spontaneous Fission Neutron Activation of Nitrogen	Be(α,n) Neutron Activation of Nitrogen	B(α,n) Neutron Activation of Nitrogen	Be(γ,n) Neutron Activation of Nitrogen	B-11(α,n)C-14 Generation of C-14
U (1 ppm)	5.5×10^{-24}	1.2×10^{-20}	7×10^{-24}	3×10^{-24}	5×10^{-24}	1.2×10^{-23}
Th (1 ppm)	1.2×10^{-24}	1.5×10^{-25}	2×10^{-24}	7×10^{-25}	7×10^{-25}	3.0×10^{-24}

Table IV. Upper Limits of Saturation C-14/C Generation by U or Th Decay Chains.

So the interface coal would be neutron activated, but the coal within would not be neutron activated. Further, coal contaminated primarily with thorium would be expected to produce very little neutron activation compared to the same concentration by weight of uranium.

Besides spontaneous fission, another source of neutrons could be generated by beryllium and boron in the coal that could produce neutrons via the Be-9(α,n), Be-9(γ,n), B-10(α,n) or the B-11(α,n) reactions. There are a number of commercially available neutron sources that produced neutrons by these reactions (Cember 1996). The source of alphas or gammas is from the uranium/thorium progeny. However, beryllium, boron and uranium are found in trace concentrations in coal in the parts-per million range (Swaine, 1990) making this an insignificant source of neutrons compared to uranium's spontaneous fission neutrons. So five modes for C-14 production in coal for the uranium and thorium decay chains are displayed in Table IV.

Table IV pertains to the Öko-Institut referenced coal with a density of 1.47 g/cm^3. The neutron activation effect is conservatively overestimated by assuming all neutrons are thermalized where the N-14(n,p)C-14 production rate is maximized. This coal's macroscopic total cross section for thermal neutrons is > 0.98 cm^{-1} and for 1.66 to 2.6 MeV gammas the range is 0.055 to 0.070 cm^{-1} (ash contribution excluded). Calculated results are for a thick coal layer, and a thin coal layer would produce a smaller result with edge effects unless a similar distribution of alpha, gamma emitters and attenuating properties of the surrounding non-coal media existed. For comparison with neutron activation, the B-11(α,n)C-14 reaction produces radiocarbon directly with a saturation C-14/C ratio $< 1.2 \times 10^{-23}$ for 1 ppm B and U.

The Be(γ,n) mode of neutron production only occurs for gamma energies > 1.66 MeV and the uranium and thorium progeny have several gamma emissions in this range.

To use Table IV, columns 3–5 are increased by increasing either the decay chain concentrations or the Be or B concentrations.

For the beryllium or boron mixed with uranium and thorium to be a significant source of C-14 would require high concentrations of Be/B, U/Th, and nitrogen. Even with unrealistic concentrations of uranium, thorium, beryllium and boron in the 1% by weight range, C-14/C equilibrium concentration ratio does not approach 10^{-14} corresponding to 40,000 years.

Besides the (α,n) reaction neutron sources listed in Table IV, there are at least 50 other isotopic (α,n) sources of neutrons. The summed neutron flux from these sources in coal is similar in magnitude to the neutron flux from spontaneous fission of uranium. Neutron activation is not a likely explanation for the observed C-14/C ratios.

The concentrations observed in coal are at least a factor of 100,000 more than what could be generated by neutron activation within the coal, and this is the best case. There is just not enough C-14 generated by the low-probability radium decays, spontaneous fission or neutron activation of the coal. *The anomalous concentrations of C-14 in coal cannot be explained by any of these generating processes. So, where did it come from?*

Can the observed levels of C-14 in coal result from contamination from the atmospheric C-14?

To answer this question, we need to construct the differential equations that describe the contamination of the coal. Consider a plane of coal of thickness d_c and area A. The following variables are defined:

N_{14} = atoms of C-14 in plane of coal of area A and thickness d_c.

N_{12} = atoms of C-12 and C-13 in plane of coal of area A and thickness d_c.

p_{14} =atoms C-14 cm^{-2} s^{-1} entering the coal from the atmosphere.

p_{12} =atoms C-12 and C-13 cm^{-2} s^{-1} entering the coal from the atmosphere.

l_{14} =atoms C-14 cm^{-2} s^{-1} leaving the coal to the atmosphere.

l_{12} =atoms C-12 and C-13 cm^{-2} s^{-1} leaving the coal to the atmosphere.

The differential equations that describe the rate of change of C-14 and C-12 and C13 is as follows:

$$\frac{dN_{14}}{dt} = (p_{14} - l_{14})A - \lambda N_{14}$$

$$\frac{dN_{12}}{dt} = (p_{12} - l_{12})A$$

The solution for these differential equations for times much greater than the half-life is

$$N_{14}(t) = \frac{(p_{14} - l_{14})A}{\lambda}$$

$$N_{12}(t) = (p_{12} - l_{12})At + N_{12}(0)$$

Now the ratio $\frac{N_{14}(t)}{N_{12}(t)}$ is the observed C-14/C ratio observed in coal today.

The ratio $\frac{p_{14}}{p_{12}}$ will be less than or equal to the atmospheric ratio of C-14/C. We will make the liberal assumption that it equals this ratio.

The ratio $\frac{l_{14}}{l_{12}}$ will be equal to the coal ratio of C-14/C.

The constant $N_{12}(0)$ is the number of atoms of C in the coal layer of area A and thickness d_c at time t=0. If we assume for every carbon atom removed, one is added ($p_{12} - l_{12}$) = 0, then with these assumptions, we calculate the rate of replacement (loss) of carbon atoms to be

$$p_{12} = l_{12} = \frac{\frac{N_{14}(t)}{N_{12}(t)} N_{12}(0)\lambda}{A\left(\frac{C-14}{C} air - \frac{N_{14}(t)}{N_{12}(t)}\right)}$$

With this information, the time to replace the initial number of carbon atoms is

$$t_{replacement} = \frac{1}{\lambda}\left(\frac{\frac{C-14}{C} air}{\frac{N_{14}(t)}{N_{12}(t)}} - 1\right)$$

So in order for the coal to be the result of contamination from the atmosphere and for the coal deposit not to grow or shrink in size, it requires the average atom of carbon is replaced within the above time frame.

For the C-14/C ratio of air being 1.4 x10^{-12} and $\frac{N_{14}(t)}{N_{12\&13}(t)}$ ratios similar to those found in coal, namely 10^{-13} to 10^{-14} this means the coal would have its carbon replaced on the order of 0.1 to 1.1 million years. Replacement of the carbon atoms every 0.1 to 1.1 million years requires coal to be a very open system with atoms entering and leaving in order to contaminate the coal with new C-14. Thus, if the noted C-14 concentrations in coal were due to contamination from new C-14 from the atmosphere, and the coal is really 300 million years old, the carbon has replaced itself many times in the millions of years since its original formation. However, the magnitude of the variation due to contamination would be expected to vary by several orders of magnitude. Variation in the thickness, depth and porosity of the rock covering the coal would be expected to produce wide variations in the C-14/C ratio, much more than just two orders of magnitude. It is on the basis of an expected greater variation in the C-14/C ratio that we can reject the likelihood of the widespread contamination of the coal layers by the atmospheric C-14.

How can 40,000 year radiocarbon dated coal be reconciled with a literal interpretation of the earth being only 6,000 years old according to the Bible?

Some creationists would find it amazing that a staunch evolutionist would look at a Lyellian dated coal deposit of 300 million years, then look at the radiocarbon date of 40,000 years and say "It is still too old to fit into any creationist chronology, since there is a factor of 7 difference with your Bible." To which a creationist could state "Yes, but I can see several reasonable explanations and being off by a factor of 7 is better than a factor of 7,000!"

It is well understood that the Specific Production Rate (SPR) is greater than the Specific Decay Rate (SDR) for the earth's carbon inventory. What this implies is that equilibrium has not been reached in the earths carbon-14 system (Whitelaw, 1992). To understand what equilibrium is we write the equation that governs the formation of C-14 from N-14 and other targets in our atmosphere

$$\frac{dN_{C-14}}{dt} = \varphi\sigma n - \lambda N_{C-14}$$

where φ is the flux of neutrons (n/cm^2-s), σ is the activation cross section for the production of C-14 via the $N^{14} + n^1 \rightarrow C^{14} + H^1$ reaction (and any other C-14 creating reactions), n is the number of target N-14 atoms and λ is the rate of decay of C-14. The first term on the right side is the rate of production and the second is the rate of decay. The solution to this differential equation is (Cember, 1996)

$$\lambda N_{C-14}(t) = \varphi\sigma n\left(1 - e^{-\lambda t}\right)$$

And if the world were millions of years old, the saturation activity of C-14 in the earth system would definitely have been reached and would be $\varphi\sigma n$. One plausible reason for unsaturation (SPR>SDR) is the world may not be millions of years old, but thousands, since the earth may have not had time to achieve saturation. For further discussion on the C-14 dating topic, see Whitelaw (1992).

Conclusion

The presence of C-14 in coal in measurable quantities is the strongest evidence that the geological ages proposed by Lyell in 1830 are pure fiction. As demonstrated, the uranium and thorium decay chains do not generate enough C-14 to explain the measured anomalous C-14/C ratios and widespread contamination of the coal by atmospheric C-14 should generate a greater variation in the observed C-14/C ratios than those found in coal. Evolution needs the millions of years that the Lyellian geological column provides, but radiocarbon dating of old carbon sources like coal clearly witness to evolutionary geologists that the Lyell geological column interpretation is misleading, it should no longer be taught as fact, and should be abandoned as a viable theory.

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C-14/C Percent Modern Carbon (pmc) ± 1 S.D.	Material	Reference
0.44 ± 0.13	Anthracite	Vogel (1987)
0.42 ± 0.03	Anthracite	Grootes (1986)
0.358 ± 0.033	Anthracite	Beukens (1992)
0.3 ± ?	Coal	Schleicher (1998)
0.2 to 0.35* (range)	Anthracite	Aerts-Bijma (1997)
0.18 ± 0.01**	Anthracite	Nelson (1986)
0.142 ± 0.023	CaC_2 from coal	Gurfinkel (1987)
0.112 ± 0.057	Bituminous coal	Kitagawa (1993)
0.081 ± 0.019	Anthracite	Beukens (1992)
* Estimated from graph ** Lowest value of multiple dates		

Table V. Accelerator Mass Spectrometry (AMS) Measurements of Coal Samples Expected to be C-14 Dead. Results borrowed from Baumgardner (2003) and Giem (2001).

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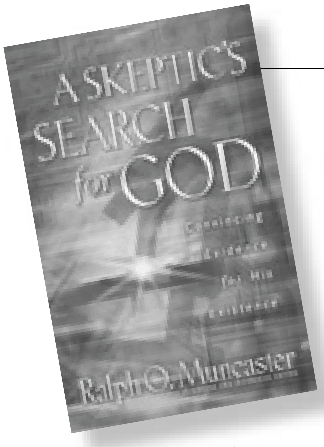
A SKEPTIC'S SEARCH for GOD
Convincing Evidence for His Existence
Ralph O. Muncaster

Book Review

A Skeptic's Search for God, Convincing Evidence for His Existence

by Ralph O. Muncaster
Harvest House Publishers, Eugene, OR. 2002, 283 pages. $11.99

This book is an autobiographical sketch combined with an analysis for evidence for the existence of God. The narrative begins with the author's early childhood belief in God and upbringing in the church. Through the early skepticism of an influential older friend, which was re-enforced by a secular college experience, Muncaster jettisoned any lingering belief in a Deity. Later in life Muncaster was confronted with a Christian who challenged him to actually try and disprove the existence of God and the accuracy of the Bible in a formal way. Muncaster picked up the gauntlet and devised an intellectually honest approach that combined consideration of analytical, statistical, and legal proofs. Muncaster approached each set of proofs from the perspective of both hard and soft evidence. He defined hard proof as the results of sciences like physics, chemistry, mathematics, and microbiology which can be measured, defined, and verified by repeated experiments. Soft sciences or "sciences of observation" include anthropology, general biology, botany, and geology. The writer used each type of proof to try to disprove the existence of God.

From this point the book is broken into three sections. The first section contains analytical proofs of God (pp. 67–121). He uses analytical proofs in an effort to show the origin of the first living cell by naturalistic evolution. The second section is on the statistical proofs for God (pp.125–194). Muncaster uses statistical analysis "to test the probability of his [God's] existence by testing for something only God could do...I could test his ability to foretell the future with perfect precision and accuracy"(p. 60). The third section consists of legal proofs of God (pp. 197–241). Legal proof has to do with eyewitness testimony, hostile witness testimony, corroborative reports, and circumstantial evidence. If analytical and statistical proofs point toward the existence of God as creator then legal proof would come into play to determine the validation of the truth claims of the various competing religious systems.

Muncaster begins with the origin of life issue that brought him into contact with the creation/evolution debate. Early on he encounters the claims of scientific creationists such as the Institute for Creation Research (pp. 73–74) and progressive creationists. The writer uses material from both sources in his quest. By using analytical evidence from the complexity of living cells, DNA and RNA studies, and the work of Michael Behe, he concludes that the origin of a single living cell could not have come about by chance and naturalistic evolution. The only alternative is creation by God.

Muncaster then uses the statistical method to test the accuracy of the Bible. "Only a God of the universe would be able to perfectly know the beginning from the end. Could the God of the Bible live up to that? How about the God of other holy books? What about other people?"(p. 129). He tests the accuracy of general Old Testament prophecies as well as specific Messianic prophecies and finds statistical evidence for both.

The author then proceeds to examine the legal evidence for the accuracy and trustworthiness of the Old Testament and New Testament documents. Included in this are the martyrdom of the apostles and early Christians, archaeological evidence, hostile witness testimony of events in Jesus' life, and the difference of the Biblical Christ contrasted to the Christ of Mormonism, Jehovah Witnesses, and Christian Science. The book is apologetic in nature and ends with an invitation to receive Christ as Savior (p. 259).

This book is written with the lay reader in mind, but also contains information making it a useful tool for the skeptics who are in our lives. A *Skeptic's Search for God* has several helpful appendices, a bibliography, endnotes, but no index.

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Consciousness: The King of Evolutionary Problems

Bert Thompson and Brad Harrub*

Abstract

Separate and apart from the brain and mind is human consciousness. Humans are unique in that we are self-aware, and can build on our own logic and understanding. In his book, The Masterpiece of Nature: The Evolution of Genetics and Sexuality, Graham Bell described the origin of sex in the following manner: "Sex is the queen of problems in evolutionary biology" (1982, p. 19). If sex is the "queen" of problems in evolutionary biology, then the evolution of consciousness surely must rank as the "king" of such problems. This paper aims to define human consciousness, and explore various possibilities for its origin. It also examines materialism in light of human consciousness. If materialistic science can explain the origin of the Universe and the origin of man, then surely it must similarly be able to explain the origin of consciousness. The fact is, however, human consciousness cannot be explained merely by mechanistic neuronal firings within the brain.

[Note: In this paper, SMALL CAPS indicate emphasis in original; *italics* indicate emphasis added.]

The Importance of Human Consciousness

When speaking of consciousness (also referred to in the literature as "self-awareness"), evolutionists freely admit that, from their vantage point at least, "consciousness is one's most precious possession" (Elbert, 2000, p. 231). David MacKay of the University of Keele in England wrote: "[Consciousness is] for us, the most important aspect of all" (1965, p. 498). As famed paleoanthropologist Richard Leakey stated: "The sense of self-awareness we each experience is so brilliant it illuminates everything we think and do…" (1994, p. 139). In their book, *Evolution*, the late geneticist Theodosius Dobzhansky and his co-authors wrote: "In point of fact, *self-awareness is the most immediate and incontrovertible of all realities*. Without doubt, the human mind sets our species apart from nonhuman animals" (Dobzhansky, et al., 1977, p. 453). Ervin Laszlo, in his volume, *Evolution: The Grand Synthesis*, commented:

> *The phenomenon of mind is perhaps the most remarkable of all the phenomena of the lived and experienced world*. Its explanation belongs to a grand tradition of philosophy—to the perennial "great questions" that each generation of thinkers answers anew…or despairs of answering at all (1987, p. 116).

The late Robert Wesson, a Hoover Institution Senior Research Fellow, observed in his book, *Beyond Natural Selection*:

> Life has a dual nature: its material basis and the essence of functionality and responsiveness that distinguishes living things and flourishes at higher levels of evolution. *The material and the mental are both real*, just as are causation

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> and will. The mind derives richness from these two sides, like feeling and bodily function, love and sex, the spiritual and the carnal, the joy of creation and the satisfaction of bodily wants (1997, p. 278).

Or, as philosopher Michael Ruse remarked: "*The important thing from our perspective is that consciousness is a real thing*. We are sentient beings" (2001b, p. 200). Sir Cyril Hinshelwood, professor of chemistry at the Imperial College in London, commented: "I almost hesitate to say this in a scientific gathering; but one does just wonder *what would be the point or purpose of anything at all if there were not consciousness anywhere*" (1965, p. 500).

And creationists certainly agree. In his work, *Understanding the Present: Science and the Soul of Modern Man*, theist Bryan Appleyard observed:

> Light, gravity, even the whole biological realm are related to us only in the most superficial way: we reflect light, if dropped we fall and we have a body system roughly comparable to a large number of animals. *All of which is trivial compared with the one attribute we have that is denied to the rest of nature—consciousness* (1992, pp. 193–194).

Yes, consciousness is a "real thing." But why is it an "important thing"? The late evolutionist and Harvard professor, Stephen Jay Gould, concluded:

> Consciousness, vouchsafed only to our species in the history of life on earth, is the most god-awfully potent evolutionary invention ever developed. Although accidental and unpredictable, it has given *Homo sapiens* unprecedented power both over the history of our own species and the life of the entire contemporary biosphere (1997, p. ix).

With consciousness has come the ability to control—well—almost everything! But with that "unprecedented power" has come unprecedented responsibility because, as even evolutionists are wont to admit, actions have consequences. Well-known evolutionist Donald Griffin, in the 2001 revised edition of his classic text, *Animal Minds: Beyond Cognition to Consciousness*, admitted as much when he wrote:

> It is self-evident that we are aware of at least some of what goes on around us and that we think about our situation and about the probable results of various actions that we might take. *This sort of conscious subjective mental experience is significant and useful because it often helps us select appropriate behavior* (p. ix).

"Selecting appropriate behavior" (or, as the case may be, *not* selecting appropriate behavior) becomes a key point in this discussion. As evolutionists John Eccles and Daniel Robinson correctly observed in *The Wonder of Being Human: Our Brain and Our Mind*: "Whether one takes human beings to be 'children of God,' 'tools of production,' 'matter in motion,' or 'a species of primate' has consequences" (1984, p. 1). Yes, as we will show, it certainly does.

The "Mystery" of Human Consciousness

Consciousness is undeniably real. And it does have consequences—something that practically every rational human freely admits. But admitting all of that is the easy part. The difficulty arises in explaining *why*—why consciousness exists; why it is real; why it works the way it does; why it "has consequences." When it comes to explaining the origin of consciousness, evolutionists admit (to use their own words): "Clearly, we are in deep trouble" (Eccles and Robinson, 1984, p. 17). Just how "deep" that "trouble" really is, appears to be one of the most widely known, yet best-kept secrets in science. In a chapter ("The Human Brain and the Human Person") that he authored for the book, *Mind and Brain: The Many-Faceted Problems*, Sir John Eccles wrote: "The emergence and development of self-consciousness…is an utterly mysterious process…. The coming-to-be of self-consciousness is a mystery that concerns each person with its conscious and unique selfhood" (1982, pp. 85,97). Or, as British physicist John Polkinghorne admitted: "The human psyche has revealed its shadowy and elusive depths" (1986, p. 5).

Consider the following admissions from those within the evolutionary community, and as you do, notice the descriptive terms ("problem," "mystery," "puzzle," "riddle," "challenge," etc.) that generally are employed in any discussion of consciousness.

> *Consciousness is the highest manifestation of life, but as to its origin, destiny, and the nature of its connection with the physical body and brain—these are as yet unsolved metaphysical questions*, the answer to which can only be found by continued research in the direction of higher physical and psychical science (Carrington, 1923, p. 54).
>
> *Nobody has the slightest idea how anything material could be conscious*. Nobody even knows what it would be like to have the slightest idea about how anything material could be conscious (Fodor, 1992, p. 5).
>
> We need to close the gap between the physical and subjective realms of this topic before we can hope to reach an understanding of consciousness. *Until then it remains*, according to *Scientific American*, "*biology's most profound riddle*" (Johanson and Edgar, 1996, p. 107).
>
> *The problem of consciousness tends to embarrass biologists*. Taking it to be an aspect of living things, they feel they should know about it and be able to tell physicists about it, whereas they have nothing relevant to say (Wald, 1994, p. 129).
>
> We believe that *the emergence of consciousness is a skeleton in the closet of orthodox evolutionism*…. It remains just as enigmatic as it is to an orthodox evolutionist as long as it is regarded as an exclusively natural process in an exclusively materialist world (Eccles and Robinson, 1984, pp. 17,18).

> What the connection, or the relationship, is between what goes on mentally in the mind and what goes on physically in the brain, nobody knows. Perhaps we shall never know. *The so-called mind/brain problem has proved so elusive, many have come to regard it as a mystery of ultimate significance*…. Unlike less complicated physical structures, *the brain is accompanied by consciousness. As we said earlier, we do not know why this should be*. For the time being at least, we must simply accept it as a brute fact (Stannard, 2000, pp. 41–42,44).
>
> *The emergence of full consciousness…is indeed one of the greatest of miracles* (Popper and Eccles, 1977, p. 129).

Consciousness Defined

The past three decades have witnessed a serious and noticeable increase in interest in the subject of consciousness, accompanied by a surge of publications, new scientific and/or philosophical journals, and scientific meetings (for examples within the last two years see: Greenfield, 2002; Tolson, 2002; Lemonick, 2003a, 2003b; Pinker, 2003).

One would think that since *so much* has been written on the subject of consciousness, surely, the definition of this oft'-discussed topic would be a straightforward, simple matter. Think again! [One dictionary on psychology had the following entry under "consciousness": "Consciousness is a fascinating but elusive phenomenon; it is impossible to specify what it is, what it does or why it evolved. Nothing worth reading has been written about it" (Sutherland, 1989).] Scientists and philosophers cannot even agree on the definition of the term, much less on the origin of that which they are attempting to define.

Our English word "consciousness" has its roots in the Latin *conscio*, formed by the coalescence of *cum* (meaning "with") and *scio* (meaning "know"). In its original Latin sense, to be conscious of something was to share knowledge of it, with someone else, or with oneself. As C.S. Lewis noted in his *Studies in Words*:

> A "weakened" sense of *conscientia* coexisted in Latin with the stronger sense, which implies shared knowledge: in this weak sense *conscientia* was, simply, knowledge. All three senses (knowledge shared with another, knowledge shared with oneself and, simply, knowledge) entered the English language with "conscience," the first equivalent of *conscientia*. The words "conscious" and "consciousness" first appear early in the 17th century, rapidly followed by "self-conscious" and "self-consciousness" (1960).

Consciousness, however, has become a rather ambiguous term in its everyday usage. It can refer to: (1) a waking state; (2) experience; and (3) the possession of any mental state. It may be helpful to the reader to provide an example of each of these three main usages: (1) the injured worker lapsed into unconsciousness; (2) the criminal became conscious of a terrible sense of dread at the thought of being apprehended; and (3) I am conscious of the fact that sometimes I get on your nerves. Anthony O'Hear suggested:

> In being conscious of myself as myself, I see myself as separate from what is not myself. In being conscious, a being reacts to the world with feeling, with pleasure and pain, and responds on the basis of felt needs…. Consciousness involves reacting to stimuli and feeling stimuli (1997, pp. 22,38).

The phrase "self-consciousness," at times, can be equally ambiguous, as it may include: (1) proneness to embarrassment in social settings; (2) the ability to detect our own sensations and recall our recent actions; (3) self-recognition; (4) the awareness of awareness; and (5) self-knowledge in the broadest sense (see Zeman, 2001, p. 1264). O'Hear went on to suggest:

> A self-conscious person, then, does not simply have beliefs or dispositions, does not simply engage in practices of various sorts, does not just respond to or suffer the world. He or she is aware that he or she has beliefs, practices, dispositions, and the rest. It is this awareness of myself as a subject of experience, as a holder of beliefs, and an engager in practices, which constitutes my self-consciousness. A conscious animal might be a knower, and we might extend the epithet "knower" to machines if they receive information from the world and modify their responses accordingly. *But only a self-conscious being knows that he is a knower* (pp. 23–24).

Neurobiologist Antonio Damasio believes that consciousness comes in two forms. First is "*core consciousness*," which is limited to the here and now, and is what we share with other higher primates. The second, which is the ingredient humans possess that makes us unique, he has labeled as "*extended consciousness*." This type of consciousness adds awareness of past and future to the mix (Tattersall, 2002, p. 73). Nobel laureate Gerald Edelman, director of neurosciences and chairman of the department of neurobiology at the Scripps Research Institute (1992, pp. 117–123), believes that we should distinguish between what he calls "primary consciousness" (equivalent to Damasio's "core consciousness") and "higher-order consciousness" (equivalent to Damasio's "extended consciousness"). [Stanford University biologist Paul Ehrlich prefers the terms "consciousness" and "intense consciousness" (2000, pp. 110–112).] What is involved in the transition from primary to higher consciousness is that the subject of the consciousness does not merely "have" experiences, but is able, over and above that, to refine, alter, and report its experiences. Primary consciousness lacks any notion of an experience or self. In other words, a "non-self-conscious" creature is aware of and/or able to react to stimuli. But higher-order consciousness represents an awareness of the plans and concepts by which one makes one's way in the world.

Ian Tattersall commented: "…[I]f consciousness were something more susceptible to scientific analysis than it is, we would certainly know a lot more about it by now than we do—which is very little indeed" (p. 59). Donald Johanson and Blake Edgar, in their book, *From Lucy to Language*, admitted that "consciousness, being inherently singular and subjective, is a tricky prospect for objective scientific analysis…" (1996, p. 107). True enough. But, as it turns out, defining it is no less of a "tricky prospect." Nobel laureate Sir Francis Crick was not even willing to give it a try. In his book, *The Astonishing Hypothesis: The Scientific Search for the Soul*, he lamented:

> Everyone has a rough idea of what is meant by consciousness. It is better to avoid a *precise* definition of consciousness because of the dangers of premature definitions. Until the problem is understood much better, any attempt at a formal definition is likely to be either misleading or overly restrictive or both. If these seems like cheating, try defining for me the word *gene* (1994, p. 20).

Richard Leakey, on the other hand, was at least willing to inquire: "What *is* consciousness? More specifically, what is it *for*? What is its *function*? Such questions may seem odd, given that each of us experiences life through the medium of consciousness, or self-awareness" (1994, p. 139). Indeed, such questions *do* seem a bit odd, considering all the "press" given to the subject of consciousness over the past many years. But, as Adam Zeman wrote in the extensive review of consciousness he prepared for the July 2001 issue of the scientific journal, *Brain*: "Whether scientific observation and theory will yield a complete account of consciousness remains a live issue" (p. 1264). A "live issue" indeed! Just getting scientists and philosophers to agree on a standard, coherent definition seems to be an almost impossible task. In his 1997 volume, *The Large, the Small and the Human Brain*, British mathematical physicist Sir Roger Penrose asked: "*What is consciousness? Well, I don't know how to define it. I think this is not the moment to attempt to define consciousness, since we do not know what it is…*" (p. 98; Penrose's central thesis is that "there should be something outside of *known* physics," p. 102).

But the fact that "we do not know what it is" has not prevented people from offering a variety of definitions for "our most precious possession," consciousness. Johanson and Edgar went on to say:

> First, *what is consciousness? No single definition may suffice for such an elusive concept*, but we can describe consciousness as self-awareness and self-reflection, the ability to feel pain or pleasure, the sensation of being alive and of being us, the sum of whatever passes through the mind (p. 107).

Their suggestion that "no single definition may suffice for such an elusive concept" has been echoed by others who have broached the puzzle of consciousness. In his 2001 book, *A Mind So Rare*, Canadian psychologist Merlin Donald noted:

> [W]e must mind our definition of consciousness. It is not really a unitary phenomenon, and allows more than one definition. In fact, it encompasses at least three classes of definition. The first is the definition of consciousness as a STATE…. A second class of functional definition takes an ARCHITECTURAL approach, whereby consciousness is defined as a place in the mind…. The third definition of consciousness takes a frankly human-centered view of cognition and has more to do with enlightenment, or illumination, than with mere attention. This is the REPRESENTATIONAL approach… (pp. 118,119,120).

For University of Washington neurobiologist William Calvin, consciousness consists of "contemplating the past and forecasting the future, planning what to do tomorrow, feeling dismay when seeing a tragedy unfold, and narrating our life story." For Cambridge University psychologist Nicholas Humphrey, an essential part of consciousness is "raw sensation." According to Steven Harnad, editor of the respected journal, *Behavioral and Brain Sciences*, "consciousness is just the capacity to have experiences" (for documentation of statements by Calvin, Humphrey, and Harnad, see Lewin, 1992, pp. 153–154). And, even though Roger Penrose started out by admitting, "I don't know how to define it," that did not keep him from offering up his own set of definitions for consciousness.

> It seems to me that there are at least two different aspects to consciousness. On the one hand, there are *passive* manifestations of consciousness, which involve *awareness*. I use this category to include things like perceptions of colour, of harmonies, the use of memory, and so on. On the other hand, there are its *active* manifestations, which involve concepts like free will and the carrying out of actions under our free will (1997, pp. 98–99).

Notice how often "consciousness" seems to be tied to "awareness" (or "self-consciousness" with "self-awareness")? There is a reason for that: the two frequently are used interchangeably in the scientific and philosophical literature. Eccles noted: "One can also use the term self-awareness instead of self-consciousness, but I prefer self-consciousness because it relates directly to the self-conscious mind" (1992, p. 3). The late evolutionist of Harvard, Kirtley F. Mather, offered his personal opinion when he said: "[A]wareness is a term that I prefer to consciousness" (1986, p. 126). In his book, *The Evolution of Consciousness*, Stanford University biologist Robert Ornstein suggested: "*Being conscious is being aware of being aware*. It is one step removed from the raw experience of seeing, smelling, acting, moving, and reacting" (1991, pp. 225–226).

Paul Ehrlich, in his 2000 text, *Human Natures: Genes, Cultures, and the Human Prospect*, also addressed the intriguing concept of "self" consciousness.

> We have a continuous sense of "self"—of a little individual sitting between our ears—and, perhaps equally important, a sense of the threat of death, of the potential for that individual—our self—to cease to exist. I call all of this sort of awareness "*intense consciousness*"; *it is central to human natures and is perhaps the least understood aspect of those natures* (p. 110).

And, last but not least, of course, let it be noted that even though certain scientists and philosophers do not know what consciousness *is*, they do know what it *is not*. As evolutionary humanist Jerome W. Elbert put it in his 2000 book, *Are Souls Real?*:

> We can define consciousness as *what it is like to be a person who is awake or dreaming and has a normally functioning brain*.... By our definition, consciousness is interrupted by dreamless sleep, and it returns when we awaken or have a dream. By almost anyone's definition, consciousness leaves when a person is under general anesthetic during surgery. The fact that consciousness can be halted and restarted is evidence that it is due to the operation of a *process*, rather than the presence of a *spiritual entity*. This is consistent with the view that consciousness arises from a dynamic process within the brain, rather than from the presumable continuous indwelling of a soul (p. 223).

Or, to quote Roger Penrose: "I am suggesting that *there are not mental objects floating around out there which are not based in physicality*" (1997, p. 97). So much, then, for the idea that self-consciousness or self-awareness has any "spiritual" origin or significance.

Why—and How— Did Consciousness Arise?

When Sir Karl Popper and Sir John Eccles stated in their classic text, *The Self and Its Brain*, that "*the emergence of full consciousness...is indeed one of the greatest of miracles*," they did not overstate the case (Popper and Eccles, 1977, p. 129). Be sure to notice their use of the word "emergence." The "miracle" of the "emergence" of consciousness has to do with two things: (1) the *fact* of its existence; and (2) the *reason* for its existence. In other words, *why* did consciousness arise, and *how* did it do so?

Why Did Consciousness Arise?

At the outset, let us state what is common knowledge (and readily admitted) within the scientific community: evolutionary theory cannot begin to explain *why* consciousness arose. In our estimation, one of the most fascinating books published within the last thirty years was a volume with the seemingly unprofessional title, *The Encyclopaedia of Ignorance* (see Duncan and Weston-Smith, 1977). But, although the title may appear somewhat whimsical, the content of the volume is anything but. In chapter after chapter, distinguished, award-winning scientists (such as Nobel laureate Sir Francis Crick and two-time Nobel laureate Linus Pauling) enunciated and explained some of the most important things in the world—*things of which science is completely ignorant*. Interestingly, one of the chapters in the book, written by Richard Gregory (professor of neuropsychology and director of the brain and perception laboratory at the University of Bristol in England), was "Consciousness." In his discussion, Dr. Gregory asked:

> Why, then, do we NEED consciousness? What does consciousness have that the neural signals (and physical brain activity) do not have? Here there is something of a paradox, for if the awareness of consciousness does not have any effect—if consciousness is not a causal agent—then it seems useless, and so should not have developed by evolutionary pressure. If, on the other hand, it is useful it must be a causal agent: but then physiological description in terms of neural activity cannot be complete. Worse, we are on this alternative stuck with mentalistic explanations, which seem outside science (1977, p. 277).

In this brief assessment, Gregory has isolated several key points. First, what does consciousness have that the brain does not? Second, if consciousness does not have some "real function," then, obviously, nature would have "selected against" it—and it never would have appeared in the first place. Third, if it does indeed have some function, in light of our current knowledge about how the neural network of the brain operates, *what is that function*? And if there is beneficial function, why have not the brains of animals selected for it? To echo Gregory's question, "Why do we *need* consciousness?"

Why indeed? Philosopher Michael Ruse noted some of the major hurdles involved in "nature" being able to "select" for consciousness when he asked:

> Even if one agrees that consciousness is in some sense connected to or emergent from the brain—and how could one deny this?—*consciousness must have some biological standing in its own right*.... But what is consciousness, and what function does it serve? Why should not an unconscious machine do everything that we can do? (2001a, p. 72).

Some materialists, of course, have suggested that a machine *can* do "everything we can do." The eminent British physiologist Lord E.D. Adrian, in the chapter he authored on "Consciousness" for the book, *Brain and Conscious Experience*, concluded: "As far as our public behavior is concerned, *there is nothing that could not be copied by machinery, nothing therefore that could not be brought within the framework of physical science*" (1965, p. 240). [Lord Adrian's remarks were made at a scientific symposium held at the Vatican in 1964. Following his speech, the seminar participants engaged in a roundtable discussion that centered on Adrian's lecture. One of those in attendance was Wilder Penfield, the renowned Canadian neurosurgeon, who dryly responded to Lord Adrian: "I had in mind to ask whether the robot could, in any conceivable way, see a joke. I think not. Sense of humor would, I suspect, be the last thing that a machine would have" (as quoted in Eccles, 1966, p. 248). Brilliant stroke!]

Evolutionary theory has no adequate answer to the question of how consciousness arose, as evolutionists Eccles and Robinson admitted.

> *[A]ll materialist theories of the mind are in conflict with biological evolution*.... Evolutionary theory holds that only those structure and processes that significantly aid in survival are developed in natural selection. *If consciousness is causally impotent, its development cannot be accounted for by evolutionary theory* (1984, p. 37).

Or, as Gregory had asked years earlier: "If the brain was developed by Natural Selection, we might well suppose that consciousness has survival value. But for this it must, surely, have causal effects. *But what effects could awareness, or consciousness, have?*" (1977, p. 276).

Evolutionists may not be able to explain what causal effect(s) consciousness might possibly have that would endow it with a "survival value" significant enough for "nature" to "select," but one thing is certain: most of them are not willing to go so far as to suggest that consciousness does not exist, or that it is unimportant to humanity. As Ruse stated:

> The average evolutionist, however, particularly the average Darwinian, feels extremely uncomfortable with such a dismissive attitude. *Consciousness seems a very important aspect of human nature.* Whatever it may be, consciousness is so much a part of what it is to be human that Darwinians are loath to say that natural selection had no or little role in its production and maintenance (2001b, p. 197).

While the "average Darwinian" may indeed be "extremely uncomfortable" with the suggestion that natural selection had "little or no role in the production and maintenance of consciousness," the truth of the matter is that no Darwinian can explain *why*, or *how*, natural selection could have played any part whatsoever in such a process. Yet, as Richard Heinberg observed in his book, *Cloning the Buddha: The Moral Impact of Biotechnology*: "Since no better material explanation is apparently available, it is assumed that whatever explanation is at hand—however obvious its shortcomings—MUST BE true. Natural selection thus becomes an inscrutable, godlike agency capable of producing miracles" (1999, p. 71).

From an evolutionary viewpoint, consciousness does not *do* anything. It does not "help" the neural circuits in the brain. It apparently does not have any "great biological significance," and it does not seem to bestow any innate "survival benefit" on its possessor. We ask, then, *what is left*? Or, to repeat Gregory's question: "Why do we *need* consciousness?"

Why Do We Need Consciousness?

From an evolutionary viewpoint, maybe we do not. W.H. Thorpe, in his chapter, "Ethology and Consciousness," for the book, *Brain and Conscious Experience*, asked regarding consciousness: "Is there a good selective reason for it or is there just no reason at all why the animal should not have got on quite as well without having developed this apparently strange and new faculty" (1965, p. 497). Perhaps, amidst all the other "happenstances" resulting from billions of years of evolution, consciousness is, to put it bluntly, a "quirky accident." Ironically (or maybe not), those are the exact words the late evolutionist Stephen Jay Gould used to describe the origin of consciousness when he said: "The not-so-hidden agenda in all this is a concern with human consciousness. You cannot blame us for being fascinated with consciousness; it is an enormous punctuation in the history of life. *I view it as a quirky accident*" (as quoted in Lewin, 1992, pp. 145–146). Or, as Sir Fred Hoyle observed of Gould's reference to consciousness being "an enormous punctuation in the history of life": "Professor Gould accepts human consciousness as an exception to his general thesis; it is a phenomenon sudden in its appearance and exceptional in its nature" (Hoyle and Wickramasinghe, 1993, p. 177). Theodosius Dobzhansky suggested:

> Self-awareness is, then, one of the fundamental, and possibly the most fundamental, characteristic of the human species. *This characteristic is an evolutionary novelty*; the biological species from which mankind has descended had only rudiments of self-awareness, or perhaps lacked it altogether (1967, p. 68).

An "exceptional evolutionary novelty" indeed! In fact, it is *so* exceptional that some evolutionists have given up altogether trying to figure out why consciousness exists at all. One such prominent figure in the field is British philosopher Colin McGinn. In speaking about McGinn's views on our inability to explain the origin of consciousness, James Trefil wrote in this book, *Are We Unique?*:

> Others have suggested more esoteric arguments about the fundamental unknowability of consciousness. For example, philosopher Colin McGinn of Rutgers University has suggested, on the basis of an argument from evolutionary theory, that the human mind is simply not equipped to deal with this particular problem. His basic argument is that *nothing in evolution has ever required the human mind to be able to deal with the operation of the human brain* (1997, p. 186).

In his 2000 volume, *Human Natures: Genes, Cultures, and the Human Prospect*, Paul Ehrlich discussed the situation as well when he wrote that McGinn doubts

> …that we will ever understand how a pattern of electrochemical impulses in our nervous systems is translated into the rich experience of, say, watching an opera or flying an airplane. He believes that *our minds did not evolve in such a way as to enable us to answer that question, which may be fated to remain unanswered for a very long time, if not forever* (p. 112).

Some evolutionists, however, are not quite ready to throw in the towel just yet. Rather than admit defeat, they have opted to defend the view that the "why" of consciousness has something to do with the brain—although they are not quite sure *what* or *how*. Stephen Jay Gould believed that the brain evolved, got bigger, and somehow produced consciousness as an "exaptation." What, exactly, is an exaptation? Let Gould himself explain. "…[W]hat shall we call structures that contribute to fitness but evolved for other reasons and were later co-opted for their current role? They have no name at present, and [Elisabeth] Vrba and I suggest that they be called 'exaptations'" (1984, p. 66; for Vrba reference, see Gould and Vrba, 1982). In other words, a big brain did not "evolve" in order to produce consciousness. If you will pardon the pun, it "had other things on its mind." Instead, for one reason or another (that no one seems quite able to explain), consciousness "just happened" as a fortuitous, unexpected by-product. Gould discussed human consciousness as one of the brain's "exaptive possibilities" when he wrote:

> An arm built for one thing can do others (I am now typing with fingers built for other purposes). But a brain built for some functions can do orders of magnitude more simply by virtue of its basic construction as a flexible computer. *Never in biological history has evolution built a structure with such an enormous and ramifying set of exaptive possibilities*. The basis of human flexibility lies in the unselected capacities of our large brain (1984, pp. 67–68, parenthetical items in orig.).

One thing remains certain: consciousness does appear to be connected to the brain. Yet that causes as many problems as it does solutions, as Gregory observed:

> We believe that consciousness is tied to living organisms: especially human beings, and more particularly to specific regions of the human brain…. This in turn generates the question: "What is the relation between consciousness and the matter or functions of the brain?" …One trouble about consciousness is that it cannot be (or has not yet been) isolated from brains, to study it in different contexts (1977, pp. 274,276, parenthetical item in orig.).

Paleoanthropologist Richard Leakey agreed:

> The most obvious change in the hominid brain in its evolutionary trajectory was, as noted, a tripling of size. Size was not the only change, however; the overall organization changed, too…. *This difference in organization presumably underlies in some way the generation of the human mind* as opposed to the ape mind. If we knew when the change in configuration occurred in human prehistory, we would have a clue about the emergence of human mind (1994, pp. 145).

One widely held view regarding the jump from the three pounds of matter inside a human skull being "just" a brain, to the type of complex brain that permits and/or produces consciousness, appears to be that once the brain reached a certain size, consciousness merely "came along for the ride." Or, as Ruse theorized:

> General opinion (my opinion!) is that somehow, as brains got bigger and better during animal evolution, consciousness started to emerge in a primitive sort of way. Brains developed for calculating purposes and *consciousness emerged and, as it were, got dragged along*. Most Darwinians think that at some point, consciousness came into its own right (2001b, pp. 197–198).

There are, however, a number of "alternative explanations" for why the brain ultimately developed consciousness. Gregory listed just a few when he wrote: "It has been suggested that: (1) mind and brain are not connected (epiphenomenalism); or (2) that the brain generates consciousness; or (3) that consciousness drives the brain; or (4) that they both work in parallel (like a pair of identical clocks) without causal connection" (1977, p. 279, parenthetical items in orig.). Then again, not everyone is ecstatic about the concept of increased brain size being responsible for something as important and quixotic as consciousness. Roger Lewin, in *Complexity: Life at the Edge of Chaos*, observed:

> I found many biologists distinctly uncomfortable with talking about increase in brain size as a measure of complexity. "I'm hostile to all sorts of mystical urges toward great complexity," said Richard Dawkins when I asked him whether an increase in computational complexity

> might be considered an inevitable part of the evolutionary process. "You'd like to think that being able to solve problems contributes to Darwinian fitness, wouldn't you?," said John Maynard Smith. "But it's hard to relate increased brain size to fitness. After all, bacteria are fit" (1992, p. 146).

Steven Pinker, the eminent psychologist from MIT, is no happier with the idea that "a big brain explains it all." In his book, *The Language Instinct*, he lamented:

> *A large-brained creature is sentenced to a life that combines all the disadvantages of balancing a watermelon on a broomstick, running in place in a down jacket, and for women, passing a large kidney stone every few years. Any selection on brain size itself would surely have favored the pinhead.* Selection for more powerful computational abilities (language, perception, reasoning, and so on) must have given us a big brain as a by-product, not the other way around! (1994, pp. 374–375).

Furthermore, "brain size," as it turns out, does not live up to its vaunted reputation. Brain size and intellect among living people have been thoroughly explored by, among others, such scientists as evolutionist W. LeGros Clark, who reported that skulls from humans of normal intelligence vary in cranial capacity anywhere from 900cc to 2,300 cc. In fact, Dr. Clark discussed one completely normal human being whose brain size was a mere 720 cc (see Clark, 1958, pp. 357–360, Howe, 1971, p. 213).

If natural selection did not "choose" consciousness (because it has no "causal effects" if consciousness has no known function (from an evolutionary point of view), and if "evolving a big brain" is not an adequate explanation for consciousness—then, to repeat our original question, *why* did consciousness arise in the first place? What does it *do*?

Some evolutionists have suggested that consciousness arose "so that people could process language." But, as Wright pointed out:

> People who claim to have a scientific answer usually turn out to have misunderstood the question. For example, some people say that consciousness arose so that people could process language…. But, whatever it may feel like, the (often unspoken) premise of modern behavioral science is that when you are in conversation with someone, all the causing happens at a physical level. That someone flaps his or her tongue, generating physical sound waves that enter your ear, triggering a sequence of physical processes in your brain that ultimately result in the flapping of your own tongue, and so on. In short: the *experience* of assimilating someone's words and formulating a reply is superfluous to the assimilation and the reply, both of which are just intricate mechanical processes (2000, p. 307).

Peter Wilson asked:

> We might choose to cite certain suggestions that language is the prerequisite, for it is only with the aid of language that we can find the way to give reality, by articulation to the inchoate intuition of the divided self. But language may play this role only in a mechanical sense, by providing a means of *expressing* and *symbolizing* consciousness (1980, pp. 85–86).

"Expressing" and "symbolizing" consciousness are not the same as "explaining" consciousness.

Alwyn Scott, in his book, *Stairway to the Mind: The Controversial New Science of Consciousness*, suggested that "consciousness gives an evolutionary advantage to the species that develops it" (1995, p. 162). But what, exactly, might that advantage be? W.H. Thorpe chose the simplest option of all: "The production of consciousness may have been an evolutionary necessity, in that it may have been the only way in which highly complex living organisms could become fully viable" (1965, p. 493). Adam Zeman, in the review of the subject of consciousness that he wrote for the journal, *Brain*, chose a different tact: "[I]t can be argued, at a conceptual level, that the concept of one's own mind presupposes the concept of other minds" (2001, p. 1281). In an article he wrote for *New Scientist* titled "Nature's Psychologists" (and, later, in his book, *A History of the Mind*), Nicholas Humphrey seized on that thought to provide one example of the type of theories that have been proposed to explain the "evolutionary advantage" of consciousness. He suggested that the purpose of consciousness is to allow "social animals" to model another's behavior on the basis of their insight into another creature's psychological motivation. In other words, our knowledge of our own mental states supplies us with insight into the mental states underlying the actions of others—which then: (a) provides us with the ability to predict what someone else is likely to do; and (b) thereby becomes a major determinant of our own biological success (1978). Or, as Paul Ehrlich asked:

> What could have been the selective advantage that led to the evolution of intense consciousness? This type of consciousness helps us to maneuver in a complicated society of other individuals, each of whom is also intensely conscious. Intense consciousness also allows us to play without acting out the plans and to consider that other individuals probably also are planning (2000, p. 113).

Not to be outdone, Merlin Donald, in *A Mind So Rare*, offered up his own supposition. "Conscious capacity," he wrote, "may be seen as an evolutionary adaptation in its own right, whose various functions have evolved to optimize or boost cognitive processing" (2001, p. 131). Ah, yes—"optimizing cognitive processing." And how would consciousness (which, as Eccles admitted, is "causally impotent") accomplish that? Then, last, but certainly not least, Ruse offers a guess.

> Slowly but positively, brain scientists do feel that they are groping toward some understanding of the virtues of consciousness, over and above the operation of blind automata. It is felt that *consciousness may act as a kind of filter and guide—coordinating all the information thrown up by the brain*. Consciousness helps to prevent the brain from getting overloaded, as happens all too often with computers. Consciousness regulates experience, sifting through the input, using some and rejecting some and storing some… (2001b, p. 198).

Thus, consciousness, so we are told: (a) acts a filter or guide to coordinate all the information thrown up by the brain; (b) prevents the brain from getting overloaded; (c) regulates experience; (d) sifts through input into the brain; and (d) rejects some experience and stores others. Pretty impressive achievement for the nebulous "something" referred to as consciousness that, supposedly, "natural selection had no or little role in producing" (Ruse), "is causally impotent" (Eccles), "is fundamentally unknowable" (McGinn), and "is not a causal agent" (Gregory). Which, in turn, brings us to our next question.

How Did Consciousness Arise?

It is not enough to ask *why* consciousness arose. One also must inquire as to *how* consciousness originated. In *Man: The Promising Primate*, Wilson asked:

> [H]ow is it possible for one species, the human, to develop consciousness, and particular self-consciousness, to such a degree that it becomes of critical importance for the individual's sanity and survival? And what is the meaning of this development in and for human evolution? (1980, p. 84).

Human consciousness is so pervasive, and so undeniable, that the mechanism of its existence *must* be explained. But how? One practically can envision Stephen Jay Gould shrugging his shoulders in exasperation, and sighing in frustration, as he admitted: "…[W]e must view the evolution of human consciousness as a lucky accident that occurred only by the fortunate (for us) concatenation of numerous improbabilities" (1984, p. 64, parenthetical item in orig.). Five years later, he continued in the same vein: "*Homo sapiens* may form only a twig, but if life moves, even fitfully, toward greater complexity and higher mental powers, then the eventual origin of self-conscious intelligence may be implicit in all that came before" (1989, p. 45). After another five years had passed, he wrote:

> *Homo sapiens* did not appear on the earth, just a geologic second ago, because evolutionary theory predicts such an outcome based on themes of progress and increasing neural complexity. Humans arose, rather, as a fortuitous and contingent outcome of thousands of linked events, any one of which could have occurred differently and sent history on an alternative pathway that would not have led to consciousness (1994, 271[4]:86).

Then, two years later, in his book, *Full House: The Spread of Excellence from Plato to* Darwin, Dr. Gould concluded:

> If a large extraterrestrial object—the ultimate random bolt from the blue—had not triggered the extinction of dinosaurs 65 million years ago, mammals would still be small creatures, confined to the nooks and crannies of a dinosaur's world, and incapable of evolving the larger size that brains big enough for self-consciousness require. If a small and tenuous population of protohumans had not survived a hundred slings and arrows of outrageous fortune (and potential extinction) on the savannas of Africa, then Homo *sapiens* would never have emerged to spread throughout the globe. *We are glorious accidents of an unpredictable process with no drive to complexity, not the expected results of evolutionary principles that yearn to produce a creature capable of understanding the mode of its own necessary construction* (1996, p. 216).

While it is convenient to surmise that consciousness is the result of a "contingent outcome of thousands of linked events," or a "glorious accident," such speculation does not explain *how* consciousness arose. So how did it arise?

On occasion (quite often, in fact), evolutionists have been known to criticize creationists for their reliance on what the evolutionists see as "just-so" stories (a phrase from Rudyard Kipling's children's book of the same title, in which fanciful explanations are offered for adaptations, such as the elephant's trunk). But, as the old adage suggests, "the sauce that is good for the goose also is good for the gander." Or, to put it another way, evolutionists are not above weaving their own "just-so" stories—when it suits their purpose.

Stephen Jay Gould—effective popularizer of evolution that he was—spun a fascinating tale of how he thought consciousness evolved. By his best guess, *human consciousness is rooted in the destruction of the dinosaurs* 65–70 million years ago as the result of a giant asteroid hitting the Earth and driving them to extinction (1996, p. 216).

Does this strike you as a bit odd? Does it leave you wondering exactly how the dinosaurs' demise could possibly account for, of all things, *human consciousness*? Little wonder, then, that Dr. Gould concluded in an article ("The Evolution of Life on the Earth") he wrote for the October 1994 issue of *Scientific American*: "*H. sapiens* is but a tiny, late-arising twig on life's enormously arborescent bush—a small bud that would almost surely not appear a second time if we could replant the bush from seed and let it grow again" (p. 91).

As far as Gould and some of his colleagues are concerned, *Homo sapiens* may be nothing but a "tiny twig" or a "small bud." But human consciousness ("our most precious possession," "the greatest of miracles") has defied every attempt by evolutionists to explain either the reason for its existence or the mechanism leading to its development. Further complicating matters is the obvious and undeniable fact that our consciousness/self-awareness allows us to experience (and express!) what Roger Penrose has referred to as "non-computable elements"—things like compassion, morality, and many others—that mere neural activity is extremely hard pressed to explain. As Dr. Penrose stated:

> There are some types of words which would seem to involve non-computable elements—for example, judgement, common sense, insight, aesthetic sensibility, compassion, morality…. These seem to me to be things which are not just features of computations…. If there indeed exists some sort of contact with Platonic absolutes which our awareness enables us to achieve, and which cannot be explained in terms of computational behaviour, then *that seems to me to be an important issue* (1997, p. 125, first ellipsis in orig., second ellipsis added).

An important issue? Talk about understatement! It is difficult enough to try to invent "just-so" stories to explain *why* consciousness arose in the first place, and then to explain *how* it did so. But to try to explain the role that consciousness plays in such "important issues" within humanity as common sense, judgment, aesthetics, compassion, and morality—well, let us just say that Michael Ruse had it right when he observed: "I hardly need say that *all of these suggestions raise as many questions and problems as they answer*. Philosophers and scientists are working hard toward answers and resolutions" (2001b, pp. 199–200). Anthony O'Hear, in his book, *Beyond Evolution: Human Nature and the Limits of Evolutionary Explanation*, remarked: "What is crucially at issue here is not how human self-consciousness might have come about, but what its significance is once it has come about" (1997, p. 22).

In a special April 10, 2000 issue of *Time* magazine devoted to the subject of "Visions of Space and Science," Steven Pinker, professor of brain and cognitive sciences at MIT and author of *How the Mind Works*, produced an article titled "Will the Mind Figure Out How the Brain Works?," in which he concluded:

> Will we ever understand the brain as well as we understand the heart, say, or the kidney? Will mad scientists or dictators have the means to control our thoughts? Will neurologists scan our brains down to the last synapse and duplicate the wiring in a silicon chip, giving our minds eternal life?
>
> No one can say. The human brain is the most complex object in the known universe, with billions of chattering neurons connected by trillions of synapses. No scientific problem compares to it. (The Human Genome Project, which is trying to read a long molecular sentence composed of billions of letters, is simple by comparison.) …. *One challenge is that we are still clueless about how the brain represents the content of our thoughts and feelings* (p. 91).

Or, as brain scientist John Beloff admitted in an article titled "The Mind-Brain Problem": "The fact is that, leaving aside mythical and religious cosmologies, *the position of mind in nature remains a total mystery*…. At present there is no agreement even as to what would count here as decisive evidence" (1994).

We would like to close this discussion about *how* consciousness arose with the following statements from Bryan Appleyard.

> Hard science will fight back at this point by attempting to deny this is a problem at all. Self-consciousness is merely a by-product of evolutionary complexity. Animals develop larger brains as survival mechanisms. Over millions of years these brains attain awesome levels of miniaturization and organization; indeed, they become the most complicated things in the universe. Then, one day, this complexity gives rise to something utterly unprecedented. …The reason such explanations feel inadequate, even though, as children of the scientific age, we probably accept them at the back of our minds, is that they are incoherent. *They do not explain self-consciousness, they explain complexity.*
>
> Of course, the hard evolutionist may still respond by claiming that this is a by-product of complexity. The elaborations and anomalies of our language and our awareness are merely a kind of surplus capacity to idle that happens to occur in the brain.... In reality, they are trivial—in the words of Peter Atkins they are "special but not significant."
>
> But, again, this is incoherent. How can it be "not significant" that we are able to use and understand the words "not significant"? What meaning can the word "significant" have in such a context? Significant to what? *If self-consciousness is "not significant," then where on earth is significance to be found?* (1992, pp. 194,195–196).

We could not have said it better ourselves. If human consciousness does not rank as being "significant," what does?

Evolutionary Bias and the Origin of Human Consciousness

Bias is a difficult thing to admit. It also is a difficult thing to overcome. Some would even say impossible. Donald

Johanson, in his book, *Lucy: The Beginnings of Humankind* (which discusses *Australopithecus afarensis*, arguably the world's most famous "hominid" fossil), addressed this subject in an admirably candid manner when he wrote: "There is no such thing as a total lack of bias. I have it; everybody has it." But Dr. Johanson did not stop there. He went on to note: "*The insidious thing about bias is that it does make one deaf to the cries of other evidence*" (Johanson and Edey, 1981, p. 277).

Oh, how true. And the veracity of this assessment is especially evident when the bias involves an intractable determination to live without God. Will Durant was a self-proclaimed humanist and avowed atheist, yet he nevertheless wrote: "The greatest question of our time is not communism vs. individualism, not Europe vs. America, not even the East vs. the West; it is whether men can bear to live without God" (1932, p. 23).

The steely resolve "to live without God" has become the mantra of many scientists and philosophers. Sir Julian Huxley, himself an atheist, compared God to the disappearing act performed by the Cheshire cat in *Alice's Adventures in Wonderland* when he wrote: "The supernatural is being swept out of the universe.... God is beginning to resemble not a ruler, but the last fading smile of a cosmic Cheshire cat" (1957, p. 59). To Huxley, and thousands of others like him, "the God argument" has been effectively routed.

Disbelief in God, though, is an *a priori* decision that *is not based on evidence!* Time and again, eminent atheists, agnostics, skeptics, and infidels have made their positions in this regard crystal clear. The widely published comments of the late biochemist and science writer, Isaac Asimov, are an excellent example. In a thought-provoking interview by the editor of *The Humanist*, Paul Kurtz, Dr. Asimov was asked how he would classify himself. He responded: "Emotionally, I am an atheist. I don't have the evidence to prove that God does not exist, but I so strongly suspect he does not that I don't want to waste my time" (Asimov, 1982, 2[2]:9).

Once a person comes to the decision that he "strongly suspects" that God does not exist, where does that leave him? With God out of the picture, two facts become prominent—and problematic—very quickly. First, a naturalistic system of origins (i.e., organic evolution) *must* be invoked to explain, not just man's origin, but *everything*! As Huxley went on to say three years after he made the above statement: "The earth was not created; it evolved. So did all the animals and plants that inhabit it, including our human selves, mind and soul as well as brain and body. So did religion" (1960, pp. 252–253).

George Gaylord Simpson of Harvard wrote that evolution "achieves the aspect of purpose without the intervention of a purposer, and has produced a vast plan without the action of a planner" (1947, p. 489). In a strictly reductionist scheme, the idea that organisms deliberately pursue goals must be rejected, since "purpose" cannot be reduced to the laws of physics. Biologist Alex Novikoff wrote: "Only when purpose was excluded from descriptions of all biological activity…could biological problems be properly formulated and analyzed" (1945, 101:212–213).

Another scientist from Harvard, E.O. Wilson (the "father of sociobiology"), noted in his book, *On Human Nature*, on the very first page: "If humankind evolved by Darwinian natural selection, genetic chance and environmental necessity, not God, made the species" (1978, p. 1). Or, as Brown University evolutionist Kenneth Miller put it in his 1999 volume, *Finding Darwin's God*:

> My particular religious beliefs or yours notwithstanding, *it is a fact that in the scientific world of the late twentieth century, the displacement of God by Darwinian forces is almost complete*. This view is not always articulated openly, perhaps for fear of offending the faithful, but the literature of science is not a good place to keep secrets. Scientific writing, especially on evolution, shows this displacement clearly (p. 15).

Second, with God having been "displaced," like it or not, man is on his own. Simpson remarked in his book, *Life of the Past*:

> *Man stands alone in the universe*, a unique product of a long, unconscious, impersonal material process with unique understanding and potentialities. *These he owes to no one but himself, and it is to himself that he is responsible*. He is not the creature of uncontrollable and undeterminable forces, but is his own master. He can and must decide and manage his own destiny (1953, p. 155).

Nobel laureate Jacques Monod, in his dismally depressing *magnum opus*, *Chance and Necessity*, concluded: "Man at least knows he is alone in the unfeeling immensity of the universe, out of which he has emerged only by chance" (1971, p. 180). But Monod's comments are "lighthearted" compared to those of another Nobel laureate, Steven Weinberg. In his book about the origin and fate of the Universe, *The First Three Minutes*, he penned what many believe are some of the most seriously disheartening words imaginable. Read, and weep.

> As I write this I happen to be in an airplane at 30,000 feet, flying over Wyoming en route home from San Francisco to Boston. Below, the earth looks very soft and comfortable—fluffy clouds here and there, snow turning pink as the sun sets, roads stretching straight across the country from one town to another. *It is very hard to realize that this all is just a tiny part of an overwhelmingly hostile universe*. It is even harder to realize that this present universe has

> evolved from an unspeakably unfamiliar early condition, and faces a future extinction of endless cold or intolerable heat. *The more the universe seems comprehensible, the more it also seems pointless* (1977, pp. 154–155).

Alas, then, as Richard Leakey and Roger Lewin claim in their book, *Origins*: "There is no law that declares the human animal to be different, as seen in this broad biological perspective, from any other animal" (1977, p. 256). A bleak thought, to be sure—but from an evolutionist's self-imposed view, inescapably true nevertheless.

Perhaps now is the time to ask: *Where does all of this inevitably lead?* Actions have consequences, and beliefs have implications. In a chapter titled "Scientific Humanism" in his book, *The Humanist Alternative*, Paul Kurtz concluded: "To adopt such a scientific approach unreservedly is to accept as *ultimate in all matters of fact and real existence the appeal to the evidence of experience alone—a court subordinate to no higher authority*, to be over-ridden by no prejudice however comfortable" (1973, p. 109). That "higher authority" must be avoided at all cost. Herman J. Eckelmann, in an article titled "Some Concluding Thoughts on Evolutionary Belief," echoed an interesting refrain when he asked: "Is it possible that one can have too high an emotional stake in wanting to have a Godless universe?" (1991, p. 345). That "emotional stake" is a driving force behind the refusal to submit to that "higher authority." If you doubt that, then listen to the admission of Harvard geneticist Richard Lewontin.

> We take the side of science IN SPITE of the patent absurdity of some of its constructs, IN SPITE of its failure to fulfill many of its extravagant promises of health and life, IN SPITE of the tolerance of the scientific community for unsubstantiated just-so stories, because *we have a prior commitment, a commitment to naturalism. It is not that the methods and institutions of science somehow compel us to accept a material explanation of the phenomenal world, but, on the contrary, that we are forced by our a priori adherence to material causes* to create an apparatus of investigation and a set of concepts that produce material explanations, no matter how counter-intuitive, no matter how mystifying to the uninitiated. Moreover, that materialism is absolute, for we cannot allow a Divine Foot in the door (1997, p. 31).

Or, as Alwyn Scott confessed:

> In the realm of science, one's attitude toward what Karl Popper called "the great tradition of materialism" is often used as an index of respectability. Those who turn away from this tradition to consider the nature of consciousness run the risk of being marked as flakes who might also believe in psychokinesis (spoon bending), mental telepathy, clairvoyance, precognition, and the like. The safest course—especially for the young scientist—is to shun such temptations and concentrate on the data from a particular level of the hierarchy (1995, p. 167, parenthetical item in orig.).

Materialism in Light of Human Consciousness

Once the scientists and philosophers have admitted their bias against God and the supernatural, and therefore have limited themselves to the purely naturalistic explanations offered by organic evolution, they are severely limited in how they can explain human consciousness—what Popper and Eccles called "the greatest of miracles." These individuals desperately desire—indeed, absolutely must have—evolution as an explanation for "whatever exists" (which includes human consciousness). As Sir Francis Crick put it: "The ultimate aim of the modern movement in biology is in fact to explain *all* of biology in terms of physics and chemistry" (1966, p. 10). Emil du-Bois-Reymand (1818–1896), the founder of electrochemistry, and Hermann von Helmholtz (1812–1894), the famed German physiologist and physicist who was the first to measure the speed of nerve impulses, agreed: "*All* the activities of living material, including consciousness, are ultimately to be explained in terms of physics and chemistry" (as quoted in Leake, 1964, pp. 5–6). Richard Leakey observed:

> This is one of the paradoxes of *Homo sapiens*: we experience the unity and diversity of a mind shaped by eons of life as hunter-gatherers. We experience its unity in the common possession of an awareness of self and a sense of awe at the miracle of life. And we experience its diversity in the different cultures—expressed in language, customs, and religions—that we create and that create us. *We should rejoice at so wondrous a product of evolution* (1994, p. 157).

Robert Ornstein wrote in *The Evolution of Consciousness*:

> Our mind did not spring from a designer, nor from a set of ideal and idealized programs…. Instead, *it evolved on the same adaptive basis as the rest of biological evolution*, using the processes of random generation and selection of what is so generated…. The story of the mind lies in many accidents and many changes of function (1991, pp. 4–5).

Ornstein went on to say:

> Working in such boundless time, all evolution needs is a tiny and consistent advantage at any point for things to add up…. In millions of years, and with a generation time of five years, there is an immense time for adaptations to tally up in prehumans. And, in living beings who reproduce quickly (in animals, generation times are only

> three or four years, and in bacteria, almost no time), major changes can occur in only a few thousand years. *E. coli*, the bacterium of choice for research, has a generation cycle of hours. Granted so much time, and selection for advantages, all the *biological miracles have had* PLENTY *of time and* PLENTY *of chance to have happened* (p. 28).

Alan Dressler dryly commented in his book, *Voyage to the Great Attractor*: "The universe has invented a way to know itself" (1994, p. 335).

Or has it? Can "biological miracles" occur just because there is supposed to have been "plenty of time and plenty of chance?" Monod wistfully wrote: "Chance alone is the source of every innovation, of all creation in the biosphere.... All forms of life are the product of chance..." (1972, pp. 110,167). Such a view, however, ascribes to "chance" properties that it does not, and cannot, possess. Sproul, Gerstner, and Lindsley addressed this logical fallacy and concluded: "Chance is incapable of creating a single molecule, let alone an entire universe. Why not? Chance is no thing. It is not an entity. It has no being, no power, no force. It can effect nothing for it has no causal power within it" (1984, p. 118).

One of the twentieth century's most eminent evolutionists was French zoologist Pierre-Paul Grassé, "whose knowledge of the living world," according to evolutionary geneticist Theodosius Dobzhansky, "was encyclopedic" (1975, p. 376). In his classic tome, *Evolution of Living Organisms*, Dr. Grassé addressed the idea of chance being responsible for evolution when he wrote: "*To insist...that life appeared quite by chance and evolved in this fashion is an unfounded supposition which I believe to be wrong and not in accordance with the facts*" (1977, p. 107).

Grassé also addressed, as did Ornstein in his quote above, bacterial generation times and their relevance to evolution. In fact, Dr. Grassé discussed the very microorganism, *Escherichia coli*, that Ornstein mentioned—yet drew an entirely different conclusion.

> Bacteria, the study of which has formed a great part of the foundation of genetics and molecular biology, are the organisms which, because of their huge numbers, produce the most mutations.... [B]acteria, despite their great production of intraspecific varieties, exhibit a great fidelity to their species. The bacillus *Escherichia coli*, whose mutants have been studied very carefully, is the best example. The reader will agree that *it is surprising, to say the least, to want to prove evolution and to discover its mechanisms and then to choose as a material for this study a being which practically stabilized a billion years ago* (p. 87).

In spite of all this, numerous scientists and philosophers exhibit a dogged determination to explain the incredible nature of human consciousness—a determination that, if we may kindly say so, is itself *incredible*! And they are not the least bit shy about admitting their built-in bias. Colin McGinn put the matter in perspective quite well when he said: "*Resolutely shunning the supernatural*, I think it is undeniable that it must be in virtue of *some* natural property of the brain that organisms are conscious. There just HAS to be some explanation for how brains [interact with] minds" (1993, p. 6).

In other words, now that it has been declared (by what almost amounts to divine fiat) that *God* did not do it, then it is obvious that "something else" must have. There just *has* to be some *naturalistic* explanation for how brains interact with minds! As Gordon Allport summarized the problem: "For two generations, psychologists have tried every conceivable way of accounting for the integration, organization and striving of the human person without having recourse to the postulate of a self" (1955, p. 37).

Whatever that explanation may be, and wherever that "self" may have come from, there is one thing evolutionists know it is *not*—God and the supernatural. Ian Glynn, in his book, *An Anatomy of Thought: The Origin and Machinery of the Mind*, admitted as much when he wrote:

> My own starting position can be summed up in three statements: first, that the only minds whose existence we can be confident of are associated with complex brains of humans and some other animals; second, that we (and other animals with minds) are the product of evolution by natural selection; and, third, that *neither in the origin of life nor in its subsequent evolution has there been any supernatural interference—that is, anything happening contrary to the laws of physics.... If the origin of life can be explained without invoking any supernatural processes, it seems more profitable to look elsewhere for clues to an understanding of the mind* (1999, p. 5).

Scott addressed this same concept.

> What, then, is the essence of consciousness? An answer to this question requires the specification of an "extra ingredient" beyond mere mechanism. Traditionally this ingredient has been called the SOUL, although the behaviorists dealt with the hard problem by denying it. *From the perspective of natural science, both of these approaches are unacceptable* (1995, p. 172).

Crick wrote: "The idea that man has a disembodied soul is an unnecessary as the old idea that there was a Life Force. This is in head-on contradiction to the religious beliefs of billions of human beings alive today. How will such a radical change be received?" (1994, p. 261).

The commitment to materialism and naturalism evinced by such statements is overwhelming. Claude Bernard, the progenitor of modern physiology, believed that the cause of *all* phenomena is *matter*, and that determinism is "the foundation of all scientific progress and criticism" (as quoted in Kety, 1960, p. 1863). Thomas Huxley reflected this position when he observed: "Thoughts are the expression of molecular changes in the matter of life, which is the source of our other vital phenomena" (1870b, p. 152). Huxley also said: "Mind is a function of matter, when that matter has attained a certain degree of organization" (1871, p. 464). He therefore concluded: "Thought is as much a function of matter as motion is" (1870a, p. 371).

Radical Materialism—A "Fishy" Theory

We are tempted to say, "Methinks thou protesteth too much!" These strained machinations—all of which are being invoked in order to deny any place to God and the supernatural—remind us of the now-famous story told by Sir Arthur Eddington in his book, *The Philosophy of Physical Science*, about the ichthyologist and his "special" net for catching fish.

> Let us suppose that an ichthyologist is exploring the life of the ocean. He casts a net into the water and brings up a fishy assortment. Surveying his catch, he proceeds in the usual manner of a scientist to systematise what it reveals. He arrives at two generalisations: (1) No sea-creature is less than two inches long. (2) All sea-creatures have gills. These are both true of his catch, and he assumes tentatively that they will remain true however often he repeats it. In applying this analogy, the catch stands for the body of knowledge which constitutes physical science, and the net for the sensory and intellectual equipment which we use in obtaining it. The casting of the net corresponds to observation; for *knowledge which has not been or could not be obtained by observation is not admitted into physical science*. An onlooker may object that the first generalisation is wrong. "There are plenty of sea-creatures under two inches long, only your net is not adapted to catch them." The ichthyologist dismisses this objection contemptuously. "Anything uncatchable by my net is *ipso facto* outside the scope of ichthyological knowledge. In short, "what my net can't catch isn't fish." Or—to translate the analogy—"If you are not simply guessing, you are claiming a knowledge of the physical universe discovered in some other way than by the methods of physical science, and admittedly unverifiable by such methods. You are a metaphysician. Bah!" (1958, p. 16).

During 1977–1978, Australian electrophysiologist and Nobel laureate Sir John Eccles (a personal friend of Sir Arthur Eddington's) was invited to present the prestigious Gifford Lectures at the University of Edinburgh in Scotland. As he began, he commented:

> The tremendous successes of science in the last century have led to the expectation that there will be forthcoming in the near future a complete explanation in materialist terms of all the fundamental problems confronting us…. When confronted with the frightening assertion by scientists that we are no more than participants in the materialist happenings of chance and necessity, anti-science is a natural reaction. *I believe that this assertion is an arrogant over-statement*, as will appear in lecture after lecture. *In fact the aim of the whole lecture series is an attack on monist-materialism, which is unfortunately believed in by most scientists with religious-like fervour. You might say that it is the belief of the establishment* (1979, pp. 8–9).

Five years later, in his book, *The Wonder of Being Human: Our Brain and Our Mind*, Eccles wrote:

> When such troubles arise in the history of thought, it is usual to adopt some belief that "saves" the day. For example, the denial of the reality of mental events, as in radical materialism, is an easy cop-out…. *Radical materialism should have a prominent place in the history of human silliness* (Eccles and Robinson, 1984, p. 17).

We agree! It is comforting to know that there are men of science as esteemed as Sir John Eccles who are willing to admit as much. It also is comforting to know that there are other individuals of the same stature in science who are willing to step forward and say essentially the same thing. Consider, as just one example, the following.

In November 1982, at the Isthmus Institute in Dallas, Texas, four renowned evolutionists who were Nobel laureates—Sir John Eccles, Ilya Prigogine, Roger Sperry, and Brian Josephson—took part in a series of very frank discussions, narrated by Norman Cousins, the highly esteemed editor of the *Saturday Review* for more than a quarter of a century. Three years later, in 1985, the four Nobel laureates released an absolutely amazing book, *Nobel Prize Conversations*, containing the entire text of those discussions, along with Mr. Cousins' narrative comments. In his "Prelude," Cousins wrote:

> Although each represented a different scientific discipline they had one thing in common: each had received the Nobel Prize, each had used the gifts of intelligence they had received in service of human life.… Another element also unites the four Nobel Laureates. *Each of them is concerned about the relation between the human mind and human brain, about the role of human consciousness in an evolving universe, about the interplay between time and mind, about the world as a "work of art" which cannot simply be reduced to neural events within the brain or to immutable mechanisms measured by quantum analysis* (pp. 4–5).

Conclusion

We leave the reader with the thought-provoking comments of Brian Josephson. Before we do, however, we offer Mr. Cousins' assessment of what you are about to read. He wrote: "Dr. Josephson has proposed that *the inclusion of God or Mind in science is not only plausible, but may even be necessary if science is ever to fully understand Nature* or to overcome its difficulties in explaining phenomena like evolution and creativity" (p. 95). Now, Josephson's remarks:

> Firstly, science casts the spotlight which it uses to search for knowledge very selectively; in other words *what scientists choose to look at, to try to explain in scientific terms, is rather restricted, rather biased. And the content of science is biased in a materialistic direction*…. Secondly, even with a particular field, science likes to look at simple phenomena, as these are more easily connected with fundamental laws. Then one tends to say, "We can explain the simple phenomena very well now; eventually, we'll be able to explain the complex phenomena as well." *The gap between simple and complex phenomena is one which scientists tend, just as a matter of faith, to assume (especially if they are of materialistic orientation) will be bridged without invoking any higher being.*
>
> An alternative approach for the scientist is to say, Let's investigate the opposite view, i.e., that *perhaps we should be taking God or Mind into account in science*; what would a science look like which had God in there playing a part, accounting thereby for particular phenomena? There are various ways into this problem, and the way I'm going to take is to say *that if we want to put God or Mind into science, then the primary feature of Mind, the one which is most closely connected with the science we've got, is intelligence* (1985, pp. 91,92–93,94).

How very refreshing! And the fact that such statements come from a Nobel laureate who is an admitted evolutionist, is, to say the very least, surprising. But Dr. Josephson is not alone in such thinking. The eminent British theoretical physicist (and former Master of Queen's College, Cambridge) John Polkinghorne expressed similar thoughts in an article he wrote in 2001 ("Understanding the Universe") for publication in the *Annals of the New York Academy of Sciences*.

> Those of us privileged to be scientists are so excited by the quest to understand the workings of the physical world that we seldom stop to ask ourselves why we are so fortunate. *Human powers of rational comprehension vastly exceed anything that could be simply an evolutionary necessity for survival, or plausibly construed as some sort of collateral spin-off from such a necessity*…. I believe that science is possible because the physical world is a creation and we are, to use an ancient and powerful phrase, creatures "made in the image" of the Creator…. With, for example, Paul Davies in his book *The Mind of God, I cannot regard this dawning of consciousness as being just a fortunate accident in the course of an essentially meaningless cosmic history*…. What I have sought to show is that religious believers who see a divine Mind and Purpose behind the universe are not shutting their eyes and irrationally believe impossible things. *We have reason for our beliefs*. They have come to us through that search for motivated understanding that is so congenial to the scientist (pp. 177,178,179,182).

Human powers of rational comprehension do indeed "vastly exceed anything that could be simply an evolutionary necessity." The primary feature of mind, it seems, is intelligence—which we see all around us. Perhaps that is what drove Eddington to say, shortly before he died: "The idea of a universal mind, or Logos, would be, I think, a fairly plausible inference from the present state of scientific theory" (as quoted in Heeren, 1995, p. 233). Or, as John Beloff put it in an article on "The Mind-Brain Problem":

> …*[T]he position of mind in nature remains a total mystery. It could be that there exists some sort of a cosmic mind*, perhaps co-equal with the material universe itself, *from which each of our individual minds stems and to which each ultimately returns.* All we can say is that it looks as if a fragment of mind-stuff becomes attached to an individual organism, at or near birth, and thereafter persists with this symbiotic relationship until that organism perishes.

Again, we say, how very refreshing.

Materialism certainly has not disproved the existence of our oh-so-vital "inner self." Nor will it ever. Steven Goldberg, in his book, *Seduced by Science*, was correct when he explained:

> *Modern science certainly does not claim that it can prove the nonexistence of the soul.* On the contrary, the dominant philosophical assumption of most twentieth-century scientists has been precisely the opposite: science deals with falsifiable propositions, that is, propositions that can be demonstrated wrong in an empirical test…. [S]cience simply does not speak to the validity of other systems, such as metaphysics, pure mathematics, or logic (1999, p. 18).

Eccles warned in his Gifford Lectures (presented at the University of Edinburgh in 1977–1978):

> We must not claim to be self-sufficient. *If we espouse the philosophy of monist-materialism, there is no base on which we can build a meaning for life or for the values*. We would be creatures of chance and circumstance. All would be determined by our inheritance and our conditioning. Our feeling of freedom and of responsibility would be but an illusion. As against that I will present my belief that *there is a great mystery in our existence and in our experiences*

> *of life that is not explicable in materialist terms*… (1979, p. 10).

After one has rightly rejected monistic materialism, what, then, is left? Eccles and Robinson observed:

> We reject materialism because, as we have seen, it does not EXPLAIN our concepts but denies them. It is at this point that we, as noble and rational beings, can give vent to the urgings of faith; not faith as the veil of ignorance, sloth, or fear, but faith as a state of mind vindicated by the efforts of reason and common sense (1984, p. 173).

How refreshing—to see a man of the stature of Sir John Eccles speak of faith "vindicated by the efforts of reason and common sense." Roger Sperry went on to say: "More than ever there is need today to raise our sights to higher values above those of material self-interest, economic gain, politics, production power, daily needs for personal subsistence, etc, to higher, more long term, more god-like priorities" (1985, pp. 158–159). German physicist Max Planck, in his *Scientific Autobiography and Other Papers* (1950), wrote:

> Religion and natural science do not exclude each other, as many contemporaries of ours would have us belief or fear; they mutually supplement and condition each other. The most immediate proof of the compatibility of religion and natural science, even under the most thorough critical scrutiny, is the historic fact that the very greatest natural scientists of all times—men such as Kepler, Newton, Leibniz—were permeated by a most profound religious attitude. Religion and natural science are fighting a joint battle in an incessant, never relaxing crusade against skepticism and against dogmatism, against disbelief and against superstition, and the rallying cry in this crusade has always been, and always will be: "On to God!" (as quoted in Eccles, 1992, p. 247).

Sadly, however, the perception persists that "faith" has somehow "lost out" to science—an idea that Dr. Eccles worked feverishly during his lifetime to dispel.

> There is a pervasive belief that religion and science are antagonistic, and that religion has been mortally defeated. This is a mistake based upon ignorance and/or prejudice. Yet atheistic materialism is the in-thing for all "tough-minded" materialists. It is surprising that this fallacious belief has been propagated despite the fact that some of the greatest scientists of this century have recognized the necessity for a religious attitude to life and to science (1992, p. 244).

In the end, Eccles was compelled to admit:

> We have to be open to some deep dramatic significance in this earthly life of ours that may be revealed after the transformation of death. We can ask: What does this life mean? We find ourselves here in this wonderfully rich and vivid conscious experience and it goes on through life; but is that the end? This self-conscious mind of ours has this mysterious relationship with the brain and as a consequence achieves experiences of human love and friendship, of the wonderful natural beauties and of the intellectual excitement and joy given by appreciation and understanding of our cultural heritages. Is this present life all to finish in death or can we have hope that there will further meaning to be discovered?… (1992, p. 251).

Twenty-five years earlier, Dr. Eccles had been even more specific. He wrote, incredibly:

> The arguments presented by [American biologist H.S.] Jennings *preclude me from believing that my experiencing self has an existence that merely is derivative from my brain* with its biological origin, and with its development under instructions derived from my genetic inheritance. If we follow Jennings, as I do, in his arguments and inferences, *we come to the religious concept of the soul and its special creation by God*…. I cannot believe that this wonderful divine gift of a conscious existence has no further future, no possibility of another existence under some other, unimaginable conditions (1967, p. 24).

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[Authors' Note: This article is an abbreviated discussion of this topic. A more complete treatment may be found in: Harrub, Brad and Bert Thompson. 2003. *The truth about human origins*. Apologetics Press, Montgomery, AL.]

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"One result of believing that God created the universe is that the visible world is regarded not simply as a set of data but as someone's achievement. This accounts for the images of artistry and craftsmanship with which biblical writers portray creation. One can scarcely talk about Genesis 1, with its elaborate symmetry and ritualistic patterning, without thinking in artistic terms. God first creates three settings (light, sky and sea, dry land and vegetation), and then, in the same order, fills them with appropriate agents (light bearers, birds, and sea creatures, land animals and people). The overall effect is that of an artist filling in a canvas."

—From the article entitled "Creation" in *Dictionary of Biblical Imagery*, General Editors: Leland Ryken, James C. Wilhoit and Tremper Longman III (Downers Grove, Ill.: InterVarsity, 1998), Pg. 180.

The Origin of Consciousness

Bert Thompson and Brad Harrub*

Abstract

The existence of human consciousness has received a great deal of attention within the scientific community. There are some who deny its existence altogether. There are those who believe it is nothing more than the result of physical properties within the brain. And there are some who contend it exists separate and apart from the brain. Many of these theories have been shaped by the desire of evolutionists to explain human consciousness via a purely materialistic/mechanistic bent. In this paper, we provide a historical background to the conflict, and examine the two broad categories—monism and dualism—that are used in an attempt to explain human consciousness. We also discuss many of their subcategories, to see how each fares in light of the available facts. Increasingly, experimental data document the fact that human consciousness is separate and distinct from the mere physical matter of the brain. This understanding indicates that there is, then, a non-material aspect of human beings that must be accounted for.

[Note: In this paper, SMALL CAPS indicate emphasis in original; *italics* indicate emphasis added.]

Theories of the Origin of Human Consciousness

In his 1997–1998 Gifford Lectures at the University of Edinburgh, Holmes Rolston said to his audience: “Humans do seem to be an exceptional species” (1999, p. 164). Indeed we are. And one of the things that makes us “exceptional” is the reality of our self-consciousness. Evolutionists acknowledge, to use Michael Ruse’s words, that “consciousness is a real thing” (2001, p. 200). Adam Zeman, in commenting on the fact that human self-awareness is intuitive, discussed just how “real” it is.

> The first intuition is that consciousness is a robust phenomenon which deserves to be explained rather than being explained away. Sensory experiences like those of colour, sound or pain, the simplest and most vivid instances of consciousness, are phenomena which any full description of the world must reckon with.... The second intuition is that consciousness is bound up with our physical being.... The third intuition is that *consciousness makes a difference*. It seems self-evident that much of our behaviour is explained by mental events; if we could not see or hear or touch, if we could not experience pain or pleasure, if we lacked conscious desires and intentions, we would not and could not behave as we do (2001, p. 1282).

But consciousness is more than merely “a real thing.” It is *important*—because “*it makes a difference!*” Stephen Jay Gould called it the “most god-awfully potent evolutionary invention ever developed (1997, p. ix).” Johanson and Edgar somewhat blushingly observed that it “adds layers of richness to our lives” (1996, p. 107). Laszlo referred to it as “perhaps the most remarkable of all the phenomena of the lived and experienced world” (1987, p. 116).

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Such comments provide powerful testimony to the ultimate importance of human consciousness. Robert Jahn and Brenda Dunne commented on the significance of the role of consciousness:

> In our age, however, as science and its derivative technologies press forward into increasingly abstract and probabilistic domains of quantum and relativistic mechanics, *the role of spirit or consciousness*—whether divine or human, individual or collective—in the structure and operation of the physical world inescapably returns to more pragmatic and theoretical relevance, and *can no longer casually be set aside if the goal is a truly comprehensive understanding of nature* (1994, p. 157).

What Popper and Eccles unhesitatingly called "the greatest of miracles—the emergence of full consciousness," *must somehow be explained* (Popper and Eccles, 1977, p. 129). Even though, as George Wald admitted, "the problem of consciousness tends to embarrass biologists" (1994, p. 129), it nevertheless finally seems to be getting its fair due in "polite discourse." Eccles himself commented: "…[T]here are now signs that the conscious self or psyche can be referred to in 'polite' scientific discourse without evoking an outrage verging on obscenity!" (1992, p. 234).

Let us, then, enter into a "polite scientific discourse" about the conscious self. Note that, as Eccles and Robinson said about humans, "we are not 'basically' or 'fundamentally or 'at root' zygotes; we are *persons*, the most extraordinary production of all" (1984, p. 51). Admitting that fact has serious implications. They continued:

> There is in all of this a chilling neglect of what can only be called a moral point of view…. What is the moral point of view, and how is it related to human happiness?… Without being specific at this point, we may say that *the moral point of view begins with man's awareness of the fact of his own transcendence; the recognition that human persons are different from and rise above those utterly material events comprised in the purely physical cosmos.*
>
> Even if a citizen has had special training in science, he is still conditioned in his daily perceptions by a pervasive METAPHYSICS that imposes a definite character on the full range of cognitive, emotional, social, and aesthetic processes—*the processes that are brought to bear on the serious matter of life* (pp. vii,viii).

Human persons undeniably "are different from, and rise above those utterly material events comprised in the purely material cosmos." Dobzhansky and his co-authors freely admitted: "Without doubt, the human mind sets our species apart from nonhuman animals" (1977, p. 453). Yes, it does—far apart! The question is: *Why?* How does the General Theory of Evolution account for the origin of the emergence of full consciousness—"the greatest of miracles"? It is our intent to answer that question. We review and discuss a veritable plethora of theories that have been proposed in what we believe are failed attempts to explain the origin of human consciousness.

The "Hard Problem" of Human Consciousness

Let us point out that not everyone within the evolutionary community believes that consciousness *can* be explained. That is the position that David Chalmers has taken. E.O. Wilson wrote concerning Chalmers' views:

> The Australian philosopher David Chalmers recently put the matter in perspective by contrasting the "easy problems" of general consciousness with the "hard problem" of subjective experience…. The hard problem is more elusive: how physical processes in the brain addressed in the easy problems give rise to subjective feeling. What exactly does it mean when we say we *experience* a color such as red or blue? Or experience, in Chalmers' words, "the ineffable sound of a distant oboe, the agony of an intense pain, the sparkle of happiness or the meditative quality of a moment lost in thought?… It is these phenomena that compose the real mystery of the mind" (1998, pp. 115–116).

This "hard problem" may be, in fact, *so* hard that it is unsolvable. As Griffin noted:

> The lack of definitive evidence revealing just what neural processes produce consciousness has led Chalmers (1996) to designate the question of how brains produce subjective awareness as the "hard problem." *He and others claim that it is such a difficult problem that normal scientific investigation is unable, in principle, to solve it*, and that consciousness must be something basically distinct from the rest of the physical universe (2001, p. 13).

In short, Chalmers' philosophical resolution of this "hard problem" is to offer a new way of thinking, which he calls *naturalistic dualism*. In essence, this is the idea that there exists both a physical realm with its own set of well-established laws, and a "consciousness" realm with its own set of "psychophysical" laws—laws, by the way, that have yet to be discovered (see Wyller, 1996, p. 218). Thus, when it comes to explaining human consciousness, science is impotent—at least for the time being. Alwyn Scott remarked:

> In the last few decades, however, science has made some progress in gathering objective information about a phenomenon that is thought by many to be ineffable. Once off limits to serious researchers, consciousness is again becoming an acceptable subject of scientific inquiry…. *Yet here, as with the efforts of ancient sages, no comprehensive*

> *understanding of consciousness has arisen from the scientific Balkanization of the subject…. Consciousness cannot, alas, be reduced to the response to an inkblot or the activity of a set of neurons* (1995, pp. 1–2).

"Failure Is Not an Option"

Darwinians realize that evolution is not "just" a theory, but also a cosmogony—i.e., an entire world view. Dobzhansky acknowledged as much when he wrote:

> Evolution comprises all the states of development of the universe; the cosmic, biological, and human or cultural developments. Attempts to restrict the concept of evolution to biology are gratuitous. Life is a product of the evolution of inorganic matter, and man is a product of the evolution of life (1967, p. 409).

Because evolution is so pervasive, whatever is *here* must be explained by evolution; there can be no exceptions—not even human self-awareness. James Trefil conceded this point:

> No matter how my brain works, no matter how much interplay there is between my brain and my body, one single fact remains. For whatever reason, by whatever process, I am aware of a self that looks out at the world from somewhere inside my skull. I would suggest to you that this is not simply an observation, but the central datum with which every theory of consciousness has to grapple. *In the end, the theory has to explain how to go from a collection of firing neurons to this essential perception* (1997, p. 181).

Not explaining consciousness is *not* an option. And so, evolutionists have no choice but to "buckle down," "put their collective noses to the grindstone," "burn the midnight oil," and devise an explanation for the origin of consciousness. Even though, to use Bryan Appleyard's summary of the problem, "hard, deterministic science's view of man is that he is a curious accident" and that "self-consciousness is a problem," it is "not of a different order from other problems…" (1992, p. 191). Yes, it is a problem. And it is a serious problem of considerable magnitude. But we will figure it out. To use Trefil's words, even though consciousness is produced by "mechanisms we still haven't worked out, *we will do so!*" (1996, p, 218).

Theories of Human Consciousness

Speaking in broad strokes, there are two main approaches to what most scientists and philosophers refer to as the "mind-body problem." Gordon Taylor assessed them as follows:

> They are known as the *dualist* and *monist*, terms I shall not be able to avoid using. Dualists maintain that the brain and the mind are two distinct beings; monists assert that they are only one thing seen from two different angles, so to speak.…. None of these views, I may as well warn you, stands up to inspection (1979, pp. 20–21).

We will review these two broad groups, and their subdivisions, in some detail. Then, as we bring this discussion on consciousness to a close, we offer a third alternative that *does* "stand up to inspection."

Dualism

The concept known as *dualism* is attributed to the seventeenth-century French physician/mathematician/philosopher René Descartes, who probably is most famous for his well-known statement, "I think, therefore I am." Interestingly, however, the idea for dualism did not originate with Descartes (although he is the one who generally receives credit for it). Earlier, Augustine, in his *City of God*, had written:

> Without any delusive representation of images and phantasms, I am most certain that I am, and that I know and delight in this. In respect of these truths, I am not afraid of the arguments of the Academicians, who say, "What if you are deceived?" For if I am deceived, I am. For he who is not, cannot be deceived; and if I am deceived, by this same token I am (see Custance, 1980, p. 28).

In the end, however, it was Descartes who "resolved to take myself as an object of study and to employ all the powers of my mind in choosing the paths I should follow" (as quoted in Fincher, 1984, p. 16). The paths Descartes chose eventually designated him as the father of the mind/body theory of *interactionism*. In his book, *Discourse on Method and the Meditations* (1642), Descartes suggested that the mind was every bit as real as matter, yet was entirely separate from matter—and therefore from the brain as well. In Descartes' language, the mind was *res cogitans* (thinking substances), as opposed to the brain, which was *res extensa* (material or physical substances). Descartes even thought he had located the "seat" of consciousness in the brain—the pineal gland. Wyller summarized Descartes' views as follows:

René Descartes is generally considered to be the originator of the modern mind-body problem…. He believed that mind states and physical states are mutually interactive—through the pineal gland in the brain. Thus arose the Cartesian mind-body dualism that still influences modern scientific thinking in this field (1996, p. 213).

It is something of a mild understatement to suggest that dualism "still influences modern scientific thinking in this field." Gilbert Ryle referred to dualism as "the official doctrine" (1949, p. 11). In commenting on that phrase,

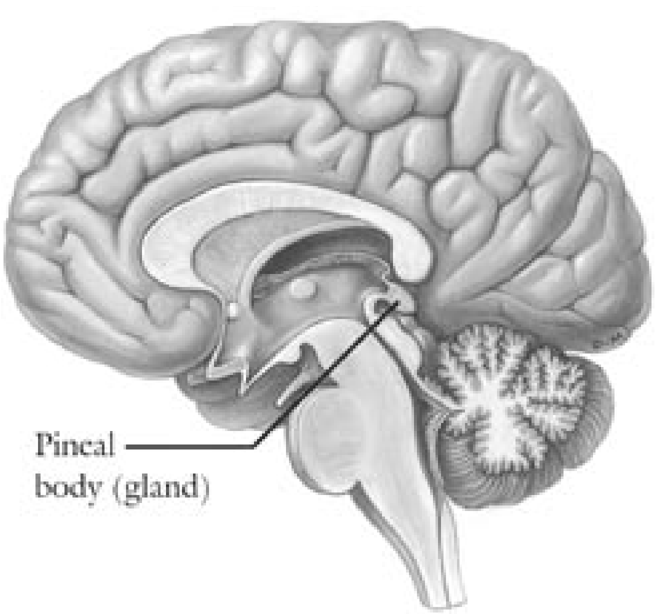

Figure 1. Descartes believed the seat of consciousness was located in the pineal gland. LifeART image copyright (2003) Lippincott Williams & Wilkins. All rights reserved.

Paul Davies asked:

> What are the features of the dualistic theory of the mind? The "official doctrine" goes something like this. The human being consists of two distinct, separate kinds of thing: the body and the soul, or mind. The body acts as a sort of host or receptacle for the mind, or perhaps even as a prison from which liberation may be sought through spiritual advancement or death…. However, the mind (or soul) is not located inside the brain, or any other part of the body; or indeed anywhere in space at all…. An important feature of this picture is that the mind is a thing; perhaps even more specifically, a substance. Not a physical substance, but a tenuous, elusive, aetherial sort of substance… (1983, p. 79).

Trefil summed it up like this:

> One way of looking at this question (which is almost certainly wrong) is to imagine that somewhere in the brain is an "I" who is watching the final products of the processing of signals by neurons. The essence of this view is that there is something in "mind" that transcends (or at least is distinct from) the workings of the physical brain. The seventeenth-century French philosopher and mathematician René Descartes advocated such a view of mind/body dualism, so the hypothetical place where mental images are viewed is often referred to as the "Cartesian Theater" (1996, pp. 217–218).

The book, *Nobel Prize Conversations*, includes the text of a series of "conversations" that occurred in November 1982, at the Isthmus Institute in Dallas, Texas, among four Nobel laureates: Sir John Eccles, Ilya Prigogine, Roger Sperry, and Brian Josephson. Norman Cousins was the moderator for those conversations. After listening to Drs. Eccles and Sperry discuss their research, documenting that the mind exerts a significant influence on the brain, Cousins was constrained to say that when we see evidence such as that produced by the scientific research of Nobel laureates like Sperry and Eccles

> …that mind is in charge of brain, we spontaneously recognize their conviction as something we've always known or at least suspected. What grips us as we listen to these men is not only the elegance of their demonstrations, nor the sheerly rational force of their arguments, but their everydayness…. *We find ourselves agreeing with Sperry and Eccles because what they say seems "right"* (1985, pp. 39–40).

Perhaps that explains, at least in part, why, as Trefil went on to note, that "[t]his so-called mind-body dualism has played a major role in thinking about mental activity ever since Descartes" (1997, p. 181).

But that is not all that Dr. Trefil had to say. He also commented: "Philosophers have, in fact, written long and detailed critiques of the Cartesian approach to the world" (1997, p. 181). Later, we will return to the idea behind Trefil's comment that "there is a sense in which something like Descartes' procedure remains valid for the question of human consciousness," because he is absolutely right in such an assessment. For now, however, we concentrate on his statement that "philosophers have, in fact, written long and detailed critiques of the Cartes ian approach to the world."

Indeed they have, as well as their counterparts in the scientific community. In his exhaustive review on "consciousness," Zeman remarked that "there is a deep dissatisfaction with the Cartesian separation of body and mind" (2001, p. 1264). But, as E.D. Adrian admitted: "…[A]greement in rejecting dualism has not been coupled with agreement in accepting anything else" (1965, p. 239). The question, then, is *why* is there such a "deep dissatisfaction"?

Simply put, there is "deep satisfaction" with the Cartesian view that body and mind are separate because: (a) such a concept is deemed "unscientific"; (b) it does not "square" with evolutionary concepts; and (c) still worse (at least in the eyes of many), it has "theological overtones." Arthur C. Custance addressed these matters as follows:

> Most of the important thinkers who followed Descartes rejected interactionism. It was not a testable hypothesis. *Above all, it introduced the supernatural into the picture and thus removed the concept from the scientific laboratory into the theological seminary*…. What emerged was

> a determination to reduce everything to physics and chemistry, or perhaps more precisely to physics and mathematics… (1980, p. 31).

Kirtley Mather was more blunt when he wrote in *The Permissive Universe*:

> I know of no scientifically verifiable data that would support the idea that the human soul is a separate entity inserted from above or without into the human body and residing therein during a person's lifetime…. Equating thus the human soul with the spiritual aspects of the life of man, it follows that *the soul, like the body or the mind, is a product of evolutionary processes*… (1986, p. 174).

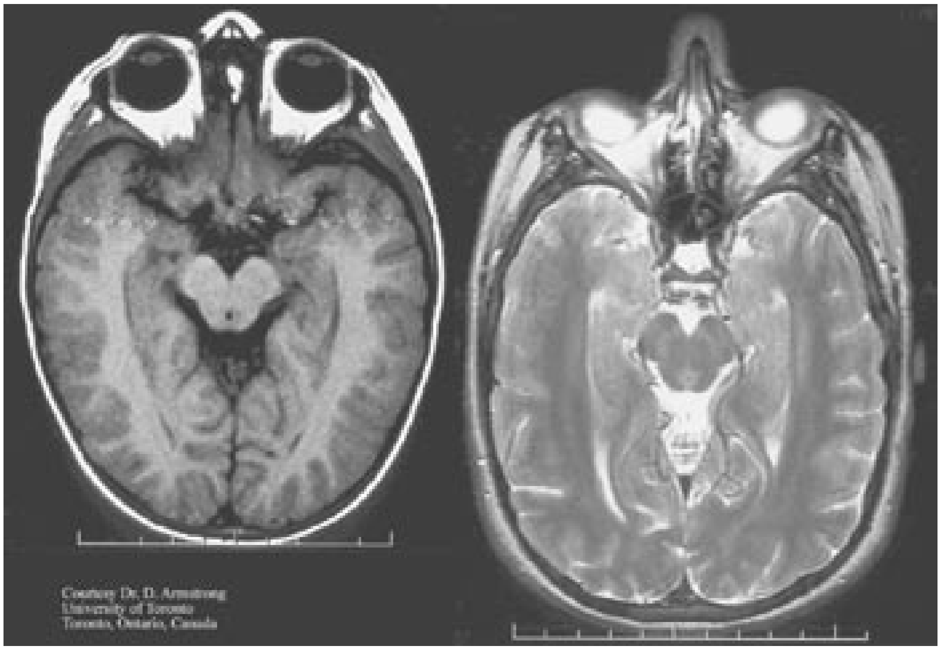

Figure 2. Is there a "Ghost in the Machine?" LifeART image copyright (2003) Lippincott Williams & Wilkins. All rights reserved.

As Sperry noted:

> [A] central requirement imposed by science would seem to be a relinquishment of dualist concepts in conformance with the explanation of mind in monist-mentalist terms. Such a shift from various dualistic, otherworldly beliefs to a monistic, this-world faith, would mean that our planet should no longer be conceived, or treated, as merely a way-station to something better beyond. This present world and life would thus in each case, acquire an added relative value and meaning (1985, pp. 159–160).

Or, to use Mather's words: "The conclusion is inescapable. Mankind's destiny is that of an earth-bound creature. Salvation must be sought here on this terrestrial planet" (1986, p. 157). Zeman concluded:

> The suggestion that conscious events are identical with the corresponding neural events offers a reductionist and materialist, or physicalist, solution to the mind-body problem…. *Why should consciousness be an exception to the stream of successful reductions of phenomena once considered to be beyond the reach of science?* (2001, 1282).

Philosopher Gilbert Ryle, played a critical role in what many today view as the final debunking of Cartesian dualism. Ryle stated clearly that his goal was to expunge once and for all the "official doctrine" of what he called "the dogma of the ghost in the machine" (pp. 15–16). The *Encyclopaedia Britannica*, in its assessment of Descartes, offered the following commentary.

> The strongest 20th-century attack on Cartesian dualism was launched by the British analytic philosopher Gilbert Ryle in *The Concept of Mind* (1949), where he exposes what he describes as the fallacy of the ghost in the machine. He argues that the mind—the ghost—is simply the intelligent behaviour of the body…. *His position, like that of the Australian philosopher J.J.C. Smart, is ultimately materialist: The mind is the brain.* The American pragmatist Richard Rorty…*says that philosophy in the Cartesian tradition is the 20th century's substitute for theology and should, like God, be gently laid to rest* (1997, p. 559).

Roger Lewin, in his discussion of human consciousness, suggested that "Cartesian dualism dominated philosophical thinking for three centuries until the British philosopher Gilbert Ryle effectively demolished it" (1992, p. 157). Ryle's attack upon Cartesian dualism was only the first of many to follow, leading E.O. Wilson to conclude: "Virtually all contemporary scientists and philosophers expert on the subject agree that the mind, which comprises consciousness and rational process, is the brain at work. They have rejected the mind-brain dualism of René Descartes…" (1998, p. 98). Or, as Michael Lemonick wrote, "Descartes was dead wrong" (2001, p. 63).

Monism

Was Descartes "dead wrong"? We do not believe that he was. We now examine monistic theories of consciousness.

Perhaps a definition of "monism" is in order. The *American Heritage Dictionary* defines monism as:

> the view in metaphysics that reality is a unified whole and that all existing things can be ascribed to or described by a single concept or system; the doctrine that mind and matter are formed from, or reducible to, the same ultimate substance or principle of being.

Ruse offered this assessment:

> *Consciousness, in some way, is simply a manifestation of the physical world.* Spinoza and his modern-day followers do not want to say that consciousness does not exist, or that it is simply material substance in a traditional way. Consciousness is obviously not round, or red, or hard, or anything like that. Rather, consciousness in some sense is emergent from or an aspect of material substances. *In other words, the notion of material substance has to be extended, from red and round and hard, to include consciousness* (2001, pp. 199–200).

According to this view, the human brain is considered to be an electrochemical machine. The mind and the brain are one, with the mind being merely an extension of the physical mechanisms of the brain (and being entirely dependent upon those mechanisms for its existence/expression). The pillar upon which modern neural science is founded—materialistic monism—contends that *all* behavior is a reflection of brain function. Thus, according to this view, everything that a person says, thinks, and does can be accounted for by certain physical actions within the brain. The "mind"—such as it is—therefore is reduced to a range of functions carried out by the physical matter within the brain. This reductive perspective allows evolutionists to then declare that matter is all that exists, and that the human brain and mind evolved from lower animals, so that humans have no "spiritual" component. There is, so it has been said, no "ghost in the machine."

Today, "for the most part, materialism, the philosophical alternative to dualism, dominates modern thinking about consciousness" (Lewin, 1992, p. 157). Lord E.D. Adrian admitted: "…[B]y the beginning of the century it was becoming more respectable for psychologists to use some kind of monism as a working hypothesis and even to be whole-hearted behaviorists" (1965, p. 239). Sir John Eccles commented:

> *The dominant theories of the brain-mind relationship that are today held by neuroscientists are purely materialistic* in the sense that the brain is given complete mastery. The existence of mind or consciousness is not denied, but it is relegated to the passive role of mental experiences accompanying some types of brain action, as in psychoneural identity, but with absolutely no effective action on the brain…. Actually, it is rare for this to be stated so baldly, but despite all the sophisticated cover-up the situation is exactly as stated. *An effective causality is denied to the self-conscious mind per se* (1992, p. 17).

Dr. Eccles' assessment is absolutely correct, and provides a satisfactory springboard from which we can investigate the "the dominant theories of the brain-mind relationship."

Psychical Monism

We discuss psychical monism first, in order to quickly dispense with it. This doctrine contends that *consciousness is the only reality—i.e., the material world only "appears" to be there*. Thoughts are causally connected, but physical events are not necessarily so. (This doctrine is the exact inverse of epiphenomenalism.) As Carrington pointed out:

> The contention of this theory is that nothing exists save states of consciousness in the individual. Neither the material world nor other minds exist (save in the mind of the individual). In refutation of this theory, it may be pointed out that, if brain changes are thus caused by, or are the outer expression of, thought—why not muscular changes, and in fact all physical phenomena throughout the world everywhere—for we cannot rationally draw the line of distinction here. Such is the logical outcome of the theory…. While many philosophers are inclined to accept this view, it may be stated that the *physical scientists are naturally repelled by it, and so is common sense* (1923, pp. 52,53).

Common sense is indeed "repelled" by psychical monism—more popularly known as solipsism—which, according to the *Cambridge International Dictionary of English*, is "the theory or view that the self is the only reality." Carrington correctly concluded: "This doctrine is so opposed to common sense and daily experience that it is unnecessary to dwell upon it" (p. 53).

Radical Materialism (Functionalism)

Currently, there exists a small-but-vocal group of philosophers that parades under the title of the "radical materialists." Previously, we quoted from Eccles and Robinson, who noted: "The existence of mind or consciousness is not denied *except by radical materialists*…" (1984, p. 34). According to Eccles, in radical materialism, "there is a denial or repudiation of the existence of mental events. They are simply illusory. The brain-mind problem is a non-problem" (1992, pp. 17–18). Today, it is unlikely that anyone is better known for defending the concept of "radical materialism" in a more formidable fashion than Daniel C. Dennett, whose reverence for Ryle's work is unabashed, and who has written many books on human consciousness (1984; 1987; 1991; 1996; 1998), including one titled *Consciousness Explained* (1991). Speaking of that book and its author,

Andrew Brown wrote:

> It is difficult to think of anyone else who would have the self-confidence to write a book called simply *Consciousness Explained*, or the nerve, once it was finished, to publish the contents under that title. It's a wonderful book; but it doesn't explain consciousness. *The heart of Dennett's position seems to be that consciousness itself is a misleading category, and that the only way to make sense of it is to redefine all one's terms in terms of externally visible states and behaviours*…. He has devoted his life to exorcising the ghost from the machine (1999, pp. 153,154).

Paul Ehrlich stated: "In *Consciousness Explained*, he takes an interesting cut at the problem, but he does not 'explain' consciousness to my satisfaction" (2000, p. 112). Nor did he explain it to anyone else's. Sir John Eccles quoted Dennett's statement from page 21 of *Consciousness Explained*, "human consciousness is just about the last surviving mystery," and then wryly commented: "It is still a mystery at the end of his 468-page book" (p. 31). In a review of Daniel Dennett's 2003 book, *Freedom Evolves*, Galen Strawson commented:

> In the last several years the philosopher Daniel C. Dennett has published two very large, interesting and influential books. The first, *Consciousness Explained* (1991), aimed to account for all the phenomena of consciousness within the general theoretical framework set by current physics. It failed, of course, and came to be affectionately known as *Consciousness Ignored*… (2003).

Dennett has indeed "devoted his life to exorcising the ghost from the machine." Speaking of himself, and others of his ilk, he wrote:

> For other, more theoretically daring researchers, there is a new object of study, the mind/brain. This newly popular coinage nicely expresses the prevailing materialism of these researchers, who happily admit to the world and to themselves that what makes the brain particularly fascinating and baffling is that somehow or other it IS the mind (1991, pp. 38–39).

As one might expect, the radical materialism espoused by Dennett has not gone down well with those who believe that consciousness *does* exist, and that it *does* matter. Even among some of his evolutionist colleagues, his ideas have drawn considerable (and substantial) criticism. In assessing Dennett's work, Trefil wrote:

> The problem comes when Dennett approaches the problem of consciousness. The first time I read his book, I became confused because about halfway through I began to think, "Hey—this guy doesn't think that consciousness exists"…. Until you have explained how I come to that central conclusion about my own existence, you have not solved the problem of consciousness. *You certainly won't solve the problem by denying that consciousness exists.* For me, reading Dennett's book was a little like reading a detailed discussion on the workings of a transmission, only to be told that there is no such thing as a car (1997, pp. 182–184).

Two aspects of radical materialism are closely associated with Dennett. The first is what he refers to as "the intentional stance," which, not coincidentally, happens to be the title of one of his books (1987). Dennett's definition in that book was this: "The intentional stance is the strategy of prediction and explanation that attributes beliefs, desires, and other 'intentional' states to systems—living and nonliving" (p. 495). Griffin investigated Dennett's position, and concluded:

> The contemporary philosopher Daniel Dennett has advocated what he calls "the intentional stance" when analyzing not only human and animal cognition but also many examples of self-regulating inanimate mechanisms…. His insistence on including such simple devices as thermostats in this extended category of intentional systems *leads him to deny any special status to conscious mental experiences…. Dennett appears to be arguing that if a neurophysiological mechanism were shown to organize and guide a particular behavior pattern, this would rule out the possibility that any conscious mental experiences might accompany or influence such behavior*… (2001, p. 263).

Griffin, of course, is renowned in his own right for his work with animal consciousness—which is why he later raised the issue of how Dennett's work questions "whether conscious mental experiences occur *in other species*" (p. 263). But Dennett's position does not question consciousness solely "in other species." It is most notorious for calling into question whether consciousness occurs in *humans*.

The second aspect of radical materialism closely associated with Dennett is the concept of "functionalism." This view ultimately arises from Dennett's strong ties to the artificial intelligence (AI) community. In reviewing Dennett's position, Johanson and Edgar explained that he

> …argues that consciousness can be understood from the metaphor of a computer. He views the mind as the software to the brain's hardware, a program that writes a narrative of our experience, edited and compiled from the multiple drafts of information streaming into the brain. In this view, the present moment of sensation is insignificant compared to the subsequent mental reflection and contemplation, from which meaning arises. Consciousness—the mind—is simply a product of the brain… (1996, p. 107).

As Scott put it, this is the view that "the essential aspects of mental dynamics will eventually be expressed as a formula and represented on a system constructed from integrated computer circuits" (1995, p. 2).

What are the implications of Dennett's brand of functionalism in regard to things such as the mind/soul? Davies wrote:

> They do not deny that the brain is a machine, and that neurons fire purely for electrical reasons—*there are no mental causes of physical processes*. Yet they still appeal to causal relations between mental states: very crudely, thoughts cause thoughts, notwithstanding the fact that, at the hardware level, the causal links are already forged....
>
> Functionalism solves at a stroke most of the traditional queries about the soul. What stuff is the soul made of? The question is as meaningless as asking what stuff citizenship is made of or Wednesdays are made of. The soul is a holistic concept. It is not made of stuff at all. Where is the soul located? Nowhere. To talk of the soul as being in a place is as misconceived as trying to locate the number seven, or Beethoven's fifth symphony. Such concepts are not in space at all (1983, pp. 85,86).

If all of this strikes you as a bit odd, let us reassure you: you are not alone. In fact, even Daniel Dennett, the current high priest of functionalism, has admitted that his ideas generally do not go down terribly well. Beloff noted:

> In dismissing the third solution from further consideration, I can do no better than John Searle (*The Rediscovery of the Mind*, 1992, p. 8) when he says, *"if your theory results in the view that consciousness does not exist, you have simply produced a reductio ad absurdum of your theory"* (1994).

We agree. Suggesting that consciousness (a.k.a., self-awareness) does not exist *is absurd!* [That fact, nevertheless, has not kept some from actually denying that consciousness exists. Lawrence Kubie wrote in *Brain Mechanisms and Consciousness: A Symposium*: "Although we cannot get along without the concept of consciousness, actually there is no such thing" (Kubie, 1956, pp. 446).] Robert Wesson concluded:

> Self-awareness is a special quality of the mind.... Self-awareness is different from information processing; even when confused and unable to think clearly, one may be vividly aware of one's self and one's confusion. The essence of mind is less data processing than will, intention, imagination, discovery, and feeling. If some kinds of thinking can be initiated by a computer, others cannot (1997, p. 277).

Roger Lewin remarked:

> To say that the brain is a computer is a truism, because, unquestionably, what goes on in there is computation. But so far, no man-made computer matches the human brain, either in capacity or design.... Can a computer think? And, ultimately, can a computer generate a level of consciousness that Dan Dennett or Nick Humphrey, or anyone else, has in mind? (1992, p. 160).

Good questions, and we all know the answers to them, do we not?

One last item bears mentioning in regard to radical materialism. It has a counterpart in psychology—behaviorism. Paul Davies wrote:

> The materialist believes that mental states and operations are nothing but physical states and operations. In the field of psychology, *materialism becomes what is known as behaviourism, which proclaims that all humans behave in a purely mechanical way in response to extern stimuli* (1983, p. 82).

According to behaviorists, only the brain exists, and mind is just an "off-shoot" of it (referred to as an "epiphenomenon"—discussed below). In the discipline of behaviorism, "mind has no independent existence and the question of the origin of mind is entirely secondary to the question of the origin and nature of brain tissue" (Custance, 1980, p. 21).

But such a position presents its own set of problems. Richard Gregory discussed some of them.

> One can well imagine that the physical state of lack of food is monitored, and signaled to brain regions which activates food-seeking behaviour; and we might describe this in an animal, or another person, to include a sensation like our feeling of hunger. It is more difficult to conceive a physiological state for shame, or guilt, or pride.... *The issue is important. It raises the question of how physiology is related to psychology, and whether consciousness can be affected or controlled apart from physiological changes* (1977, pp. 278–279).

Behaviorism has fallen onto hard times of late—and for several good reasons, among which are the ones summarized below by Beloff, who referred to behaviorism as "methodologically misleading, philosophically false, and ideologically pernicious." And that was the kindest thing he had to say!

> My first charge against Behaviourism is that it commits what Aldous Huxley once called "The Original Sin of the Intellect: Oversimplification.... Secondly, I regard behaviourism as incompatible with any genuine morality.... Our conclusions were that it was methodologically misleading, philosophically false and ideologically pernicious. But in the end, *perhaps its most glaring fault is simply a certain unmistakable* SILLINESS *which qualifies it, surely, as one of the oddest intellectual aberrations of the twentieth century* (1962, pp. 47,48,49).

John Eccles (1994) threw down the gauntlet in what he termed a "challenge to all materialists" (p. x). He expressed sharp criticism of, among others, Sir Francis Crick and his collaborator, Christof Koch, when he referred to their work as "science fiction of a blatant kind" (p. 30). But he reserved his harshest criticism for Daniel Dennett's brand of radical materialism when he referred to functionalism as an "impoverished and empty theory" (p. 33). Why characterize functionalism in such terminology? In John Searle's uncompromising words: "... the deeper objection can be put quite simply: the theory has left out the mind" (as quoted in Zeman, 2001, p. 1283).

Panpsychism

In his work, *Lay Sermons, Addresses, and Reviews*, Thomas H. Huxley had a chapter titled "On the Physical Basis of Life." Within that chapter was this sentence: "Thoughts are the expression of molecular changes in the matter of life, which is the source of our other vital phenomena" (1870, p. 152). Lord Adrian concluded: "…[N]ow we can add that there is no need to invoke extraphysical factors to account for any of the public activities of the brain…. Consciousness is a logical construction…. It arises when unconscious processes are integrated; its base line in the individual and in the animal kingdom is arbitrary" (1965, pp. 239–240,246).

This is the essence of the view known as panpsychism. When Gregory asked: "What is the relation between consciousness and the matter or functions of the brain?" (1977, p. 274), he hit at the very heart of panpsychism, which is the view that "some primordial consciousness attaches to all matter, presumably even to atoms and subatomic particles" (Eccles and Robinson, 1984, p. 37). As Eccles and Robinson remarked in regard to the radical materialism that we discussed above:

> The alternative is to espouse panpsychism. All types of panpsychists evade the problems by proposing that *there is a protoconsciousness in all matter*, even in elementary particles! According to panpsychism, the evolutionary development of brain is associated merely with an amplification and refinement of what was already there as a property of all matter. It merely is exhibited more effectively in the complex organizations of the brains of higher animals (p. 14).

Huxley put it like this: "Mind is a function of matter, when that matter has attained a certain degree of organization" (1871, p. 464). But, there is a caveat. To quote Eccles, while "it is asserted that all matter has an inside mental or protopsychical state, *since this state is an integral part of matter, it can have no action on it*" (1992, p. 17).

According to this view, then, consciousness *does* exist—everywhere, all the time, in every material thing. In the case of human beings, it "just happened" to come together in a "certain degree of organization" that permitted consciousness to be expressed, and generated self-awareness as the end result. However, after all is said and done, as Rupert Sheldrake correctly noted: "The conscious self [has]…a reality which is not merely derivative from matter" (1981, p. 203). Paul Davies commented: "We still have no clue how mind and matter are related, or what process led to the emergence of mind from matter in the first place" (1995). With some understatement, Zeman confessed: "…[W]e have no clear understanding of what kind of property could render physical events intrinsically mental" (2001, 124:1284). Not surprisingly, then, Eccles and Robinson concluded: "[Panpsychism] finds no support whatsoever in physics" (1984, p. 37).

Epiphenomenalism

During our discussion of the concept of consciousness, the terms "epiphenomenon," "epiphenomena," or "epiphenomenalism" have appeared. We postponed any discussion of epiphenomenalism until this point, because it is best considered under the subject of the monist-materialist views that we are discussing.

Epiphenomenalism, according to Eccles, is the view that "mental states exist in relation to some material happenings, but causally are completely irrelevant" (1992, pp. 17). The *Merriam-Webster Dictionary* defines epiphenomenon as "a secondary phenomenon accompanying another and caused by it." For example, pathologists frequently use the word to refer to the secondary symptoms of a disease. So, when Eccles says that epiphenomenalism suggests that mental states exist, but "causally are completely irrelevant," his point is that, like in a disease, *the symptom does not cause anything, but is itself caused by something else*. That, in essence, is how epiphenomenalism works. Shadworth Hodgson proposed that conscious mental events were caused by physical changes in the nervous system, but could not themselves cause physical changes. As one writer put it: "Like the whistle of a railway engine (which does not affect the engine), or the chime of a clock (which does not affect the clock), they were caused by (and accompanied) physical events, but they did not themselves act as causal agents. In a slightly later terminology, they were EPIPHENOMENA…" (Glynn, 1999, p. 8).

The man who referred to himself as "Darwin's bulldog," Thomas Huxley, coined the term "epiphenomenalism" in an article he authored for the *Fortnightly Review* in 1874. The time was ripe for him to originate such a concept because, as Beloff explained, "…the view that prevailed among scientists of the late 19th century was to look for the causes of our behaviour in the brain alone…. For the epiphenomenalist, the brain was a machine, like everything else in nature, and the mind no more than a passive reflection of its activity" (1994). Huxley, therefore,

> proposed that as the noise of the babbling brook is only a by-product of the rushing water, so the mind, though distinct from the brain, is nevertheless only a by-product of it. The brain therefore causes the mind as the brook causes the babbling, but the mind cannot have any influence on the brain any more than the babbling can have any influence on the brook. This was termed epiphenomenalism (Custance, 1980, p. 23).

Today, from the perspective of the reductionist-materialist, epiphenomenalism is as good an explanation as any, since "so far as we can tell, mental activity is always associated with nervous activity" (Glynn, 1999, p. 9). Griffin wrote: "Conscious thinking may well be a CORE FUNCTION of central nervous systems…. The fact that we are consciously aware of only a small fraction of what goes on in our brains has led many scientists to conclude that consciousness is an epiphenomenon or trivial by-product of neural functioning" (2001, p. 3).

Richard Lewontin and Stephen Jay Gould argued that language, consciousness, and, in fact, most of our other distinctively human mental capacities are merely "side effects" of the fact that our brain grew big for "other reasons" (reasons, they say, by the way, that cannot be reconstructed). According to Lewontin, our extraordinary human abilities are "epiphenomena of all those loose brain connections with nothing to do" (as quoted in Schwartz, 1999).

Referring to human consciousness as a "trivial by-product" or a "side effect" seems to be the height of folly (if not conceit). Being asked to think of self-awareness as a "symptom" of a "disease" (i.e., the brain) is not much better. And, apparently, we are not the only ones who think so. Eccles and Robinson referred to the concept of epiphenomenalism as "gibberish."

> The epiphenomenalist's causal theory should not be confused with the ordinary causal laws of the physical sciences. The latter are confined to the manner in which force and matter are distributed in time and space. But with epiphenomenalism we are faced with a radically different entity—a MENTAL entity—taken to be nonmaterial and nonphysical. *If it exists at all, then by definition it cannot be composed of or reduced to material elements or combinations thereof.* To say that it "arises" from these is, alas, gibberish (1984, p. 55).

But why is this the case? The two authors continued:

> But note that in any purely physical interaction, it is never NECESSARY that event A cause event B; it is merely contingently the case, given the composition and laws of the physical world, that events of type A happen to cause or faithfully lead to events of type B. Accordingly, to argue that brain states, in a natural-causal fashion, produce mental states is to admit that it could be otherwise. ALL PURELY NATURAL PHENOMENA COULD BE OTHER THAN THEY ARE. Thus, the epiphenomenalist, to the extent that he endorses a causal theory of brain-mind relationships, can never establish that the brain is NECESSARY in order that there be mind. There is nothing logically contradictory in the claim that there are minds without brain and brains without minds…. Once it is granted that there are genuinely mental (nonphysical) events, it follows that an exhaustive inventory of the PHYSICAL universe and its laws must be incomplete as an inventory of real existents, because mental events are left out. If there can be mind in addition to matter, there can mind without matter (p. 55).

No epiphenomenalist would willingly want to go *that far*. Mind without matter? Eccles and Robinson are absolutely correct, of course: "To argue that brain states…produce mental states is to admit that it could be otherwise." And it gets progressively worse for the epiphenomenalist, as Ian Glynn pointed out:

> *[I]f mental events are epiphenomena, they cannot have any survival value.* Darwin's struggle for existence is a struggle in the physical world, and if mental events cannot cause physical effects they cannot affect the outcome in that struggle. *But if they cannot affect the outcome—if they have no survival value—why should we have evolved brains that make them possible?…* That they make conscious thought possible is not relevant, for thought that merely accompanies behaviour without influencing it will be ignored by natural selection….
>
> *Even if the notion that mental events are epiphenomena is true, it leaves unexplained what most needs explaining. Why should particular physical changes in our nervous systems cause feelings or thoughts? Even epiphenomena need to be accounted for*…. So despite its promising start, the notion that mental events are epiphenomena has not got us out of the difficulties that a combination of commonsense and physics got us into (1999, pp. 10,11–12).

It seems that we keep returning to that phrase "common sense." And rightly so! Would that there were *more* of it in discussions by philosophers and scientists regarding the subject of human consciousness. Things that are counterintuitive may just be—*wrong*. Depriving humans of free will is no small matter. In speaking of the implications of John Searle's work, Rodney Cotterill remarked:

> Searle also stresses the importance of *intentionality*, by which he means that mental states are usually related to, or directed toward, external situations and circumstances…. One aspect of intentionality concerns CHOICE, irrespective of whether this implies the exercise of free will. *Even if choices were not really free, the fact that we are able to handle it would still warrant contemplation*. Searle's point

> is well taken…. *Searle has identified one of the defining characteristics of the higher organism* (1998, p. 320).

Free will *is* "one of the defining characteristics of higher organisms." And it does exist—sort of.

Roger Sperry wrote:

> Unlike "mind," "consciousness," and "instinct," "free will" has made no comeback in behavioral science in recent years. Most behavioral scientists would refuse to list free will among our problems outstanding, or at least as an unanswered problem…. *Every advance in the science of behavior*, whether it has come from the psychiatrist's couch, from microelectrode recording, from brain-splitting, or from the running of cannibalistic flatworms, *seems only to reinforce that old suspicion that free will is just an illusion. The more we learn about the brain and behavior, the more deterministic, lawful, and causal it appears* (1977, p. 432).

And so, we are asked to believe that free will is "just an illusion." It appears that the best the evolutionists can do is to suggest that "in the abstract there may be no free will," but "in practice," there really is. Paul Ehrlich has suggested exactly that:

> That enormous complexity of our brains can also, in a way, explain humanity's famed "free will." …Thus, although in the abstract there may be no free will, in practice the brains of human beings evolved so that intentional individuals can make real choices and can make them within a context of ethical alternatives…. Natural selection has endowed us with the capacity to figure out a course of action in virtually any situation, "accepting" the possibility that a chosen course may prove unfortunate (2000, pp. 124,125).

[After reading a quotation like the one above from Ehrlich, we cannot help but wonder if the people who write such things ever read them?!]

But what is the *origin* of human free will? Steven Pinker is convinced that the explanation is "all in the circuits." He testified:

> *These circuits are what we call "free will," and providing them with information about the likely consequences of behavioral options is what we call "holding people responsible."* All normal people have this circuitry, and that is why the existence of genes with effects on behavior should not be allowed to erode responsibility in the legal system or in everyday life (2003, p. 99).

Not everyone is willing to buy into such a hypothesis, however. As Paul Davies asked: "Where is there room in the deterministic predictive laws of electrical circuitry for FREE WILL?" (1983, p. 74). Or, in the words of Daniel Dennett:

> If the concept of consciousness were to "fall to science," what would happen to our sense of moral agency and free will? If conscious experience were "reduced" somehow to mere matter in motion, what would happen to our appreciation of loge and pain and dreams and joy? If conscious human beings were "just" animated material objects, how could anything we do to them be right or wrong? (1991, pp. 24–25).

Sir John Eccles, though by his own admission a committed Darwinian (see Eccles, 1967, p. 7; 1977, p. 98), argued strongly—from his own research into the relationship between mental intentions and neural events—in behalf of free will, what he called "the freedom to know and freedom to act" (see Cousins, 1985, p. 152). As Eccles stated:

> If we can establish that we have freedom to bring about simple movements at will, then more complex social and moral situations must also in part at least be open to control by a voluntary decision, i.e., of mental thought processes. Thus we have opened the way to the consideration of personal freedom and moral responsibility (1985, p. 154).

There is one thing epiphenomenalism does *not* do—and that is "open the way to the consideration of personal freedom and moral responsibility." To quote E.O. Wilson:

> And old impasse nonetheless remains. *If the mind is bound by the laws of physics*, and if it can conceivably be read like calligraphy, *how can there be free will?* I do not mean free will in the trivial sense, the ability to choose one's thoughts and behavior free of the will of others and the rest of the world all around. I mean, instead, *freedom from the constraints imposed by the physiochemical states of one's own body and mind* (1998, p. 119).

If the mind is "bound by the laws of physics," then "how can there be free will?" Herbert Feigl lamented: "Scientific psychology, as the well-known saying goes, having first lost its soul, later its consciousness, seems finally to lose its mind altogether" (1967, p. 3).

The truth of the matter is, however, that: "If consciousness has a biological function at all, it must ultimately be manifest in behaviour" (Zeman, 2001, p. 1280). Yet, as Eccles and Robinson rightly remarked: "Observable *behavior* is not a reliable guide to comprehending the psychological dimension of life…. Morally we are possessed of 'oughts,' which, as we have argued, have absolutely no material or physical reference" (1984, pp. 52,169).

Identity Theory

Earlier, we quoted Gordon Taylor, who has acknowledged that monists are "split into those who deny that mental events exist at all…and *those who claim that mental events are just physical events described in another language. This last position [is] known as identity theory*" (1979, pp. 20–21). Herbert Feigl, one of the identity theory's most ardent defenders, described the concept in this manner:

> I think that it is precisely one of the advantages of the

> identity theory that *it removes the duality of two sets of correlated events*, and replaces it by the much less puzzling duality of *two ways of knowing the same event*—one direct, the other indirect (p. 106).

In our judgment, identity theory is not exactly an easy concept to comprehend. Listen to the following definition offered by Feigl, who began by stating that "it will be advisable first to state my thesis quite succinctly," and then offered the following "succinct" summary:

> The raw feels of direct experience as we "have" them, are empirically identifiable with the referents of certain specifiable concepts of molar behavior theory, and these in turn are empirically identifiable with the referents of some neurophysiological concepts…. *The identity thesis which I wish to clarify and to defend asserts that the states of direct experience which conscious human beings "live through," and those which we confidently ascribe to some of the higher animals, are identical with certain aspects of the neural processes in those organisms*….[I]dentity theory regards sentience…[as] the basic reality (1967, pp. 78,79,107).

Feigl's "clarification" appears to be anything but. Let us simply note by way of summary that identity theory (a.k.a., "phenomenalistic parallelism") suggests that while sentience itself is indeed "the basic reality," whatever hints of consciousness that an organism (including a human) might experience are, in fact, the end result of "neural processes." Brain and consciousness (or mind and body) are but two different expressions of one underlying reality—just as the convex and concave surfaces of a sphere are but two expressions of an underlying reality. As Ruse described it:

> [M]ost Darwinians who think about these sorts of things are inclined to some kind of monism, or (as it is often known today) to some kind of *identity theory*. They think that *body and mind are manifestations of the same thing*, and that as selection works on one it affects the other, and as it works on the other it affects the former (2001, pp. 199–200).

The key phrase, of course, is that "body and mind are manifestations of the same thing." And so, "mental" events are just "physical" events" described in another language. Eccles offered this synopsis:

> Mental states exist as an inner aspect of some material structures that in present formulations are restricted to brain structures such as nerve cells. This postulated "identity" may appear to give an effective action, just as the "identical" nerve cells have an effective action. However, *the result of the transaction is that the purely material events of neural action are themselves* SUFFICIENT *for all brain-mind responses* (1992, pp. 17–18).

However, Eccles had earlier debunked such a view.

> Most brain scientists and philosophers evade this confrontation across such a horrendous frontier by espousing some variety of psychoneural parallelism. The conscious experiences are regarded as merely being a spin-off from the neural events, every neural event being postulated by its very nature to have an associated conscious experience. This simple variety of parallelism is certainly mistaken, because the great majority of neural activities in the brain do not give rise to conscious experiences. Parallelism also is unable to account for the experience that thought can give rise to action, as in the so-called voluntary movements, which must mean that cognitive events can effect changes in the patterns of impulse discharges of cerebral neurons….
>
> The most telling criticism against parallelism can be mounted against its key postulate that the happenings in the neural machinery of the brain provide A NECESSARY AND SUFFICIENT EXPLANATION OF THE TOTALITY BOTH OF THE PERFORMANCE AND OF THE CONSCIOUS EXPERIENCE OF A HUMAN BEING (1977, pp. 75–76).

Furthermore, four years prior to that, Dr. Eccles had pointed out that, in identity theory,

> …it is postulated that all neuronal activity in the cerebrum comes through to consciousness somehow or other and is all expressed there. An often-used analogy is that neuronal activity and conscious states represent two different views of the same thing, one as seen by an external observer, the other as an inner experience by the "owner" of the brain. *This proposed identification, at least in its present form, is refuted by the discovery that after commissurotomy, none of the neuronal events in the minor hemisphere are recognized by the conscious subject* (1973, pp. 218–219).

[A commissurotomy is a procedure wherein the corpus callosum (the great tract of approximately 200 million nerve fibers) that links the brain's two hemispheres is surgically severed, thereby disconnecting the two hemispheres from each other. Connections of the hemispheres to lower brain regions (known as the basal ganglia or midbrain) remain intact, and the person on whom the surgery has been performed remains relatively unaffected (Eccles, 1989, pp. 205–210).] Dr. Eccles' point is well taken. If certain neuronal events no longer are recognized by the "owner" of the brain, yet that "owner" still is conscious, the consciousness is something more than simply "neuronal events." In the book Eccles edited on *Brain and Conscious Experience*, he had concluded: "There can be much complex functional activity going on in the fully organized human brain and yet it does not reach consciousness. *I think it is very important to appreciate that it is not just complex nerve structure that gives consciousness*" (1966, p. 499).

John Searle (1992) argued that mental phenomena are caused by neurophysiological processes in the brain, and are themselves features of the brain. He referred to this point of view as "biological naturalism," and suggested that "mental processes are as much a part of our biological natural history as digestion, mitosis, meiosis, or enzyme secretion" (see Scott, 1995, p. 132). Beloff, in his discussion of identity theory, expressed serious doubts about its explicatory value.

> Thus the so-called "mind-brain identity" theory, associated with Herbert Feigl in the United States and with Bertrand Russell in Britain, which flourished during the 1950s, insisted that the mental events we associate with consciousness just ARE the relevant brain events but viewed, as it were, from the inside rather than the outside. Whether such a formulation is even tenable, I am still very doubtful; *it begs the question as to whether two entities that have entirely different properties could, ontologically, be regarded as one and the same* (1994).

But surely that is just the point! How can two entities that have completely different properties be regarded as "one and the same"? Is it not obvious that identity theory fails to account for the important *qualitative* properties of consciousness—the features that we experience in the first person as an "I" or a "me." Identity theory cannot begin to explain what Eccles referred as "the certainty of my inner core of unique individuality" (1992, p. 240).

Nonreductive Materialism/Emergent Materialism

Without doubt, one of the most vocal supporters of monistic materialism is Sir Francis Crick (1994), who suggested that, eventually, *everything* will be explicable in terms of the neural pathways in the brain—a claim that he correctly identified in the title of his book as "astonishing!" During the twentieth century, refinements of monistic-materialistic concepts appeared under the name of *nonreductive materialism*. C.D. Broad and certain of his contemporaries held the view that the brain is the seat of all mental capacities, but they simultaneously maintained that while "mental states" *emerge from* the physical substratum of the brain, those mental states are not *reducible to* the brain. This view came to be called *emergent materialism* (see Wyller, 1996, p. 215). In the words of Jerome Elbert:

> EMERGENT PROPERTIES OF MATTER [ARE] DESCRIBED AS PROPERTIES THAT EMERGE FROM MATTER WHEN SPECIAL CIRCUMSTANCES APPLY TO IT, SUCH AS THE ORGANIZATION OF THE MATTER INTO LARGE NUMBERS OF SIMILAR UNITS THAT CAN INTERACT WITH EACH OTHER. CONSCIOUSNESS MAY BE THE MOST CHALLENGING EXAMPLE OF SUCH AN EMERGENT PROPERTY. It gives matter a radically new property that is acquired only under very special conditions. Think of what a tiny fraction of the solar system's matter is conscious! (2000, pp. 215,243).

Alwyn Scott concurred: "Thus, I suggest, consciousness is an EMERGENT phenomenon, one born of many discrete events fusing together as a single experience" (1995, p. 3).

One of the best-known advocates of emergentism is philosopher John Searle. In opposition to the pure reductionists, Searle argues that first-person mental experiences ("I am in pain") cannot be reduced to mere neural firings, for in so doing, important first-person features like subjectivity are lost. In opposition to the dualists, however, Searle suggests that the strict dichotomy between mental and physical properties should be discarded. Mental properties are simply "one kind of property" that physical things can possess. *Pain and other mental phenomena are just features of the brain (and perhaps the rest of the central nervous system)* [Searle, 1984, p. 19]. Consciousness, therefore, is simply a higher-order feature of the brain. Searle denies that consciousness transcends the physical, or that it possesses causal powers that cannot be explained by the interactions of the brain's neurons. According to this view, as Reichenbach and Anderson pointed out, "consciousness has no life of its own apart from that in which it is realized. But because of this, Searle's emergentist view leaves no room for free moral agency" (1995, p. 286). Such an assessment is correct, as Searle himself admitted:

> *As long as we accept this conception of how nature works, then it doesn't seem that there is any scope for the freedom of the will* because on this conception the mind can only affect nature in so far as it is a part of nature. But if so, then like the rest of nature, its features are determined at the basic micro-level of physics (1984, p. 93).

Consciousness, then, according to this theory, is viewed as something that has "emerged from" the neural pathways of the brain, but, in and of itself, is not reducible to those neural pathways.

Another well-known advocate of the nonreductive physicalist viewpoint is Roger Sperry, who adopted a view diametrically opposed to that of Crick's monist-materialism, yet was unwilling to accept the form of dualism advocated by Eccles. He concluded:

> *Consciousness is conceived to be a dynamic emergent property of brain activity, neither identical with nor reducible to, the neural events of which it is mainly composed*.... Consciousness exerts potential causal effects on the interplay of cerebral operations.... In the position of top command at the highest levels in the hierarchy of brain organization, the subjective properties were seen to exert control over the biophysical and chemical activities at subordinate levels (as quoted in Jeeves, 1998, p. 88).

Sperry's concept is what is referred to as a "top-down view" (like that of Dr. Eccles) where mental events are given ontological priority. But, unlike Eccles, Sperry is adamant about avoiding any hint of dualism. Thus, while the emergent materialists may claim that mental states emerge from the physical substratum of the brain without being reducible to the brain, the fact remains, as Ernst Mayr noted, "emergentism is a thoroughly materialistic philosophy" (1982, p. 64).

The nonreductive physicalist view regards mental activity and correlated brain activity as "inner" and "outer" aspects of one complex set of events, which together constitute "conscious human agency." As Jeeves explained:

> The irreducible duality of human nature is on this view seen as *duality of aspects rather than duality of substance*…. It does not mean that the mind is a mere epiphenomenon of the physical activity of the brain. We may think of the way the mind "determines" brain activity as analogous to the relation between the software and the hardware of our computers. According to this view, we regard mental activity as EMBODIED IN brain activity rather than as being IDENTICAL WITH brain activity (1998, p. 89).

Sperry discussed the concepts behind emergent materialism. He began by noting that, in emergent materialism, "the traditional difference between the physical and the mental (as subjectively perceived) is deliberately retained, but with these previously separate, dual realms not inextricably merged..." (1994, p. 110). In Sperry's view, conscious or mental phenomena are "dynamic, emergent phenomena (or configurational) properties of the living brain in action" (1985, p. 66). In commenting on this, Cousins remarked:

> This seems to imply that the source of mental intentions is the brain itself in living action—but that once these emergent mental properties appear, they have causal control potency over the "lower" activities of the brain at the subnuclear, nuclear and molecular levels. *Mind emerges from brain, then takes charge as chief or director in the complex chain of command within the brain.* In Sperry's view, there is no need to appeal to any source outside the living brain in order to explain the origin and existence of mental phenomena (1985, pp. 66–67).

Cousins is correct. Sperry stated:

> One can agree that the scientific evidence speaks against any preplanned purposive design of a supernatural intelligence. At the same time the evidence shows that the great bulk of the evolving web of creation is governed by a complex pattern of great intricacy with many mutually reinforcing directive, purposive constraints at higher levels, particularly. The "grand orderly design" is, in a sense, all the more remarkable for having been self-developed (1985, p. 87).

But Sperry did not end there. Rather, he went on to comment:

> In my view, *mental phenomena as dynamic emergent properties of physical brain states become inextricably interfused with, and thus inseparable from, their physiologic substrates*…. [I]t still seems to me a mistake overall to abandon the age-old common-sense distinction between mind and matter, the mental and the physical. This basic common distinction long preceded the varied philosophic jargon and scientific terminology. *The highly distinctive specialness of conscious states with their subjective qualities does not go away just because they are taken to be emergent properties of physical brain processes* (pp. 109–110,111).

Dr. Sperry appears to "want it both ways." He believes that it is a mistake to abandon the distinction between the physical and the mental, and admits that consciousness endows a "highly distinctive specialness" that does not disappear just because someone (like him) claims that it is merely an "emergent property of physical brain processes." Yet he wants to believe that "the scientific evidence speaks against any preplanned purposive design of a supernatural intelligence" and that "there is no need to appeal to any source outside the living brain in order to explain the origin and existence of mental phenomena." Richard Heinberg contradicted Sperry with commonsense facts of nature when he commented:

> We each make plans, formulate goals, and pursue strategies routinely. And there is every indication that other creatures do the same, if perhaps not as consciously. The evidence is so persuasive that many biologists who otherwise subscribe to a reductionist-mechanist view are nevertheless forced to acknowledge some capacity of inner purpose on the part of organisms (1999, pp. 65,67–68).

Medawar and Medawar wrote in agreement: "Purposiveness is one of the distinguishing characteristics of living things. OF COURSE birds build nests in order to house their young, and equally obviously, the enlargement of a second kidney when the first is removed comes about to allow one kidney to do the work formerly done by two" (1977, pp. 11–12). Cell biologist Edmund Sinnot remarked:

> Life is not aimless, nor are its actions at random. They are regulatory and either maintain a goal already achieved or move toward one which is yet to be realized…. [Every living thing exhibits] activity which tends toward a realization of a developmental pattern or goal…. Such teleology [purpose], far from being unscientific, is implicit in the very nature of the organism (1961, p. 41, bracketed items added).

Sir John Eccles strongly disagreed with Sperry, when he wrote:

> Great display is made by all varieties of materialists that their brain-mind theory is in accord with natural law as it now is. However, this claim is invalidated by two most

> weighty considerations. Firstly, *nowhere in the laws of physics or in the laws of the derivative sciences, chemistry and biology, is there any reference to consciousness or mind*…. Regardless of the complexity of electrical, chemical or biological machinery, there is no statement in the "natural laws" that there is an emergence of this strange non-material entity, consciousness or mind. This is not to affirm that consciousness does not emerge in the evolutionary process, but merely to state that *its emergence is not reconcilable with the natural laws as at present understood* (1992, pp. 19–20).

Sperry may *want* emergent materialism to be true, but, as Eccles so eloquently pointed out, such "is not reconcilable with the natural laws as at present understood."

Dualist-Interactionism

As we began our examination of theories of human consciousness, we quoted Gordon Taylor, who assessed a number of the theories of the mind and then stated: "None of these views, I may as well warn you, stands up to inspection" (1979, pp. 20–21). Our comment at the time was: "As we bring this discussion on consciousness to a close, we want to offer a third alternative that *does* 'stand up to inspection.'" Earlier, we quoted from Adam Zeman who, in his review, "Consciousness," mentioned that "the current fascination with consciousness reflects the mounting intellectual pressure to explain how 'vital activity' in the brain generates a 'mental element,' with rich subjective content" (2001, p. 1284). In other words: *Whence comes consciousness*?

Surely, by now it is evident from our review that all of the monist-materialistic concepts have failed miserably to offer any cogent, consistent, and adequate theory about the origin of human consciousness. Acknowledgment of that fact prompts the question: "Why, then, do so many scientists and philosophers cling to the monist-materialist viewpoint?"

We are convinced that the monist-materialistic view has remained so deeply ingrained because the only legitimate alternative—some form of dualism—postulates a supernatural origin for human self-awareness! And we cannot do better to prove our point than to quote from Daniel Dennett.

> In short, the mind is the brain. According to the materialists, we can (in principle) account for every mental phenomenon using the same physical principles, laws, and raw materials that suffice to explain radioactivity, continental drift, photosynthesis, reproduction, nutrition, and growth. *It is one of the main burdens of this book to explain consciousness without ever giving in to the siren song of dualism*….
>
> The standard objection to dualism was all too familiar to Descartes himself in the seventeenth century, and it is fair to say that neither he nor any subsequent dualist has ever overcome it convincingly. If mind and body are distinct things or substances, they nevertheless must interact; the bodily sense organs, via the brain, must inform the mind, must send to it or present it with perceptions or ideas or data of some sort, and then the mind, having thought things over, must direct the body in appropriate action. Hence the view is often called Cartesian interactionism or interactionist dualism….
>
> There is the lurking suspicion that the most attractive feature of mind stuff is its promise of being so mysterious that it keeps science at bay forever. *This fundamentally unscientific stance of dualism is, to my mind, its most disqualifying feature, and is the reason why in this book I adopt the apparently dogmatic rule that dualism is to be avoided at all costs.* It is not that I think I can give a knock-down proof that dualism, in all its forms, is false or incoherent, but that, given the way dualism wallows in mystery, *accepting dualism is giving up* (1991, pp. 33,34,37).

In Dennett's view, *monistic-materialism must rule!* The acceptance of something—anything—outside of science is unthinkable, and represents what Jacques Monod referred to as "animism" (belief in spirits). In his book, *Chance and Necessity*, Monod addressed this matter in very blunt terms.

> Animism established a covenant between nature and man, a profound alliance outside of which seems to stretch only terrifying solitude. Must we break this tie because the postulate of objectivity requires it? [Monod answers "Yes!"—BT/BH]
>
> …[A]ll these systems rooted in animism exist outside objective knowledge, outside truth, and are strangers and fundamentally HOSTILE to science, which they are willing to use but do not respect or cherish. The divorce is so great, *the lie so flagrant, that it can only obsess and lacerate anyone who has some culture or intelligence*, or is moved by that moral questioning which is the source of all creativity. It is an affliction, that is to say, for all those who bear or will bear the responsibility for the way in which society and culture will evolve….
>
> The ancient covenant is in pieces; *man knows at last that he is alone in the universe's unfeeling immensity, out of which he emerged only by chance* (1972, pp. 31,171–172,180).

Animism, says Monod, is a "lie so flagrant, that it can only obsess and lacerate anyone who has some culture or intelligence." Why does he write in such terrifyingly angry words about a belief in something other than the monist-materialist viewpoint? Perhaps Carrington answered that question best when he wrote that in animism

> …we have the world-old notion of mind or soul, and body, existing as separate entities, influencing each other. Mind is here supposed to influence matter, and utilize it for the purposes of its manifestation. Were such a theory true, it would of course enable us to accept not only the reality of psychic phenomena but *the persistence of individual human consciousness after death. The main objection to this doctrine is that it postulates a form of* DUALISM, *which is very obnoxious to many minds!* It is possible, however, that such a doctrine may one day be forced upon us by the gradually increasing evidence furnished us by psychical research (1923, p. 53).

Those of the monist-materialist bent know full well what the implications would be if they were to allow any form of dualism. As Custance asked: "[H]ow can we account for 'mind' if it did not originate in the physical world?" (1980, p. 20). Let us answer that by quoting two of Monod's evolutionist colleagues—Eccles and Robinson.

> It is not in doubt that each human recognizes its own uniqueness…. *Since materialist solutions fail to account for our experienced uniqueness, we are constrained to attribute the uniqueness of the psyche or soul to a supernatural creation.* To give the explanation in theological terms: Each soul is a Divine creation, which is "attached" to the growing fetus at some point between conception and birth. It is the certainty of the inner core of unique individuality that necessitates the "Divine creation." *We submit that no other explanation is tenable* (1984, p. 43).

Strong stuff, that. But equally strong was their out-and-out condemnation of the monist-materialist viewpoint.

> [T]he denial of the reality of mental events, as in radical materialism, is an easy cop-out…. *Radical materialism should have a prominent place in the history of human silliness. We regard promissory materialism as a superstition without a rational foundation.* The more we discover about the brain, the more clearly do we distinguish between the brain events and the mental phenomena, and the more wonderful do both the brain events and the mental phenomena become. *Promissory materialism is simply a religious belief held by dogmatic materialists…who often confuse their religion with their science* (1984, pp. 17,36).

So what is the alternative? Darwin's contemporary, Alfred Russel Wallace, addressed that question in 1903 when he wrote:

> The other body and probably much larger would be represented by *those who, holding that mind is essentially superior to matter and distinct from it, cannot believe that life, consciousness, mind and products of matter*. They hold that the marvelous complexity of forces, which appear to control matter, if not actually to constitute it, *are and must be mind products* (as quoted in Wyller, 1996, p. 231).

James Trefil conceded: "Nonetheless, *there is a sense in which something like Descartes' procedure remains valid for the question of human consciousness*" (1997, p. 181). Paul Davies wrote: "…[P]hysics, which led the way for all other sciences, is now moving towards a more accommodating view of mind…" (1983, p. 8). He is correct. In fact, speaking of Cartesian dualism, Custance maintained:

> The theory cannot be disproved so long as there are mental phenomena whose neural correlates remain unknown. That there ARE mental phenomena cannot be doubted for reasons which are logically compulsive and were adopted (though not invented) by Descartes; they cannot be doubted because the very act of doubting them establishes their reality. *The reality of conscious existence is confirmed each time it is denied*…. Most of the important thinkers who followed Descartes rejected interactionism…. *But slowly, as the evidence has accumulated, it appears that the monistic view is showing signs of insufficiency and a new dualism is in the making* (1980, pp. 30,31).

Custance is correct. There is now a "new dualism in the making." In speaking of the evolutionary emergence of self-consciousness, for example, various writers (e.g., Lack, 1961, p. 128; Lorenz, 1971, p.170) have even broached the subject of the "unbridgeable gap or gulf between soul and body." Carl Gustav Jung summed up this idea of a separate mind/body interaction when he said: "I simply believe that some part of the human Self or Soul is not subject to the laws of space and time" (as quoted in Davies, 1983, p. 72). Lord Adrian claimed: "…[T]he gulf between mental and material can scarcely be called self-evident." Then he quietly admitted:

> Yet for many of us there is still the one thing which does seem to lie outside that tidy and familiar framework. That thing is ourself, our ego, the I who does the perceiving and the thinking and acting, the person who is aware of his identity and his surroundings. As soon as we let ourselves contemplate our own place in the picture we seem to be stepping outside the boundaries of natural science (1965, pp. 239,240).

Or, as Eccles concluded: "It is my thesis that we have to recognize that the unique selfhood is the result of a supernatural creation of what in the religious sense is called a soul" (1982, p. 97).

Notice Carrington's conclusion, however: "It is possible, however, that such a doctrine may one day be forced upon us by the gradually increasing evidence furnished us by psychical research" (1923, p. 53). Even Zeman admitted that "a number of commentators believe that some version of this…'dual-aspect' theory holds out the greatest promise of an eventual solution to the philosophical conundrum of consciousness" (2001, 124:1284). Roger Lewin conceded:

> [F]or the most part, materialism, the philosophical alternative to dualism, dominates modern thinking about consciousness.... True, Cartesian *dualism is not completely dead*, as evidenced in the views of Sir John Eccles, one of this century's greatest neurologists... (1992, p. 157).

John Gliedman admitted:

> From Berkeley to Paris and from London to Princeton, prominent scientists from fields as diverse as neurophysiology and quantum physics are coming out of the closet and *admitting they believe in the possibility, at least, of such unscientific entities as the immortal human spirit and divine creation* (1982, p. 77).

One of the scientists discussed by Mr. Gliedman at some length was Sir John Eccles. Daniel Dennett wrote: "Ever since Gilbert Ryle's classic attack (1949) on what he called Descartes' 'dogma of the ghost in the machine,' dualists have been on the defensive" (1991, p. 33). *Not any more!* He was opposed by John Eccles. Dr. Eccles, until his death in 1997 at the age of 94, was one of the world's most eminent electrophysiologists. He graduated from Oxford, where he studied under the man he called "the greatest neuroscientist of the age, Sir Charles Sherrington" (Eccles, 1994, p. 13). He was knighted by Queen Elizabeth II in 1958, and five years later in 1963 won the Nobel Prize in Medicine or Physiology (shared with Alan L Hodgkin and Andrew F. Huxley) for his research on the biophysical properties of synaptic transmission. Gliedman had this to say about Eccles:

> At age 79, Sir John Eccles is not going "gentle into the night." Still trim and vigorous, the great physiologist has declared war on the past 300 years of scientific speculation about man's nature. Winner of the 1963 Nobel Prize in Physiology or Medicine for his pioneering research on the synapse—the point at which nerve cells communicate with the brain—*Eccles strongly defends the ancient religious belief that human beings consist of a mysterious compound of physical and intangible spirit.... Our nonmaterial self controls its "liaison brain" the way a driver steers a car or a programmer directs a computer. Man's ghostly spiritual presence, says Eccles, exerts just the whisper of a physical influence on the computerlike brain, enough to encourage some neurons to fire and others to remain silent.* Boldly advancing what for most scientists is the greatest heresy of all, Eccles also asserts that our nonmaterial self survives the death of the physical brain (1982, p. 77).

Anyone familiar with neurophysiology or neurobiology knows the name of Sir John Eccles. (One of us [BH] studied Dr. Eccles' works while earning a Ph.D. in neurobiology.) But for those who might not be familiar with this amazing gentleman, we would like to introduce Dr. Eccles via the following quotation that Norman Geisler authored:

> The extreme form of materialism believes that mind (or soul) *is* matter. More modern forms believe mind is REDUCIBLE TO matter or DEPENDENT ON it. *However, from a scientific perspective much has happened in our generation to lay bare the clay feet of materialism. Most noteworthy among this is the Nobel Prize winning work of Sir John Eccles. His work on the brain demonstrated that the mind or intention is more than physical. He has shown that the supplementary motor area of the brain is fired by mere intention to do something, without the motor cortex of the brain (which controls muscle movements) operating.* So, in effect, the mind is to the brain what an archivist is to a library. The former is not reducible to the latter (1984, pp. 140–141).

Eccles, and his lifelong friend, Sir Karl Popper viewed the mind as a distinctly non-material entity. But neither did so for religious reasons. Dr. Eccles was a committed Darwinian evolutionist (as was Popper). Rather, they believed what they did about the human mind because of their scientific research! Speaking specifically of human self-consciousness, Eccles wrote:

> It is dependent on the existence of a sufficient number of such critically poised neurons, and, consequently, only in such conditions are willing and perceiving possible. However, it is not necessary for the whole cortex to be in this special dynamic state.... On the basis of this concept [activity of the cortex—BT/BH] we can face up anew to the extraordinary problems inherent in a strong dualism—interaction of brain and conscious mind, brain receiving from conscious mind in a willed action and in turn transmitting to mind in conscious experiences.... *Let us be quite clear that for each of us the primary reality is our consciousness—everything else is derivative and has a second order reality.* We have tremendous intellectual tasks in our efforts to understand baffling problems that lie right at the center of our being (1966, pp. 312,327).

Dr. Eccles spent his entire adult life studying the brain-mind problem, and concluded that the two were entirely separate. In the book from which we quoted (*Nobel Conversations*), Norman Cousins, who moderated a series of conversations among four Nobel laureates, including Dr. Eccles, made the following statement: "Nor was Sir John Eccles claiming too much when *he insisted that the action of non-material mind on material brain has been not merely postulated but scientifically demonstrated*" (1985, p. 68). Eccles wrote:

> When I postulated many years ago, following Sherrington, that there was a special area of the brain in liaison with consciousness, I certainly did not imagine that any definitive experimental test could be applied in a few years. But now we have this distinction between the dominant hemisphere in liaison with the conscious self, and the minor hemisphere with no such liaison (1973, p. 214).

We add this note. On March 15, 1952, the *British Medical Journal* ran an obituary notice for Sir Charles Sherrington. The notice read as follows:

> The death on March 4, 1952 of Sir Charles Sherrington at the age of 94 marked the passing of the man of genius who laid the foundations of our knowledge of the functioning of the brain and spinal cord. His classic work *Integrative Action of the Nervous System*, published in 1906, is still a source of inspiration to physiologists all over the world. It was reprinted as recently as 1947 for the first post-war (World War II) International Congress on Physiology. His work did for neurology what the atomic theory did for chemistry. It is still refreshing as it was in 1906, and it has needed no revision.

How embarrassing it must be for evolutionists to have to admit that this "genius" who "laid the foundation of our knowledge of the functioning of the brain and spinal cord" told one of his prized students, Sir John Eccles, just prior to his (Sherrington's) death: "*For me now, the only reality is the human soul*" (as quoted in Popper and Eccles, 1977 p. 55). What an amazing statement from the man who constructed many of the pillars on which modern neuroanatomy now stands! Cousins continued:

> *Eccles is the one who showed that the mental acts of intention* INITIATE *the burst of discharges in a nerve's brain cell.* He has tried to re-enfranchise the human mind, to get science to recognize thinking as a more comprehensive human activity than the mere operation of neural mechanisms....
>
> In any event it is clear that both you [Eccles—BT/BH] and Dr. [Roger] Sperry are upholding a "mentalist revolution" in science. Strictly orthodox materialists may doubt such a revolution and label it an atavistic throwback to "prescientific" perceptions of nature which believed that non-material reality could act on the material. *But in fact, both of you have reached your conclusions through the rigorous discipline of the laboratory. If you are persuaded that mental realities initiate and direct biochemical reactions in the brain, it is scientific experimentation, not philosophical speculation, that has convinced you* (1985, pp. 56,21,57).

What, precisely is the relationship between mind and brain? Eccles answered as follows.

> How can the mental act of intention activate across the mind-brain frontier those particular SMA [supplementary motor area—BT/BH] neurons in the appropriate code for activating the motor programs that bring about intended voluntary movements? The answer is that, DESPITE THE SO-CALLED "INSUPERABLE" DIFFICULTY OF HAVING A NON-MATERIAL MIND ACT ON A MATERIAL BRAIN, IT HAS BEEN DEMONSTRATED TO OCCUR BY A MENTAL INTENTION—NO DOUBT TO THE GREAT DISCOMFITURE OF ALL MATERIALISTS AND PHYSICALISTS (1985, pp. 55–56).
>
> *[W]e have discovered that mental intentions act upon the SMA in a highly selective, discriminating manner.* In a fashion which is not yet fully understood, mental intentions are able to activate across the mind-brain frontier those PARTICULAR SMA neurons that are coded for initiating the specialized motor programs that cause voluntary movements. As I remarked earlier, this may present an "insuperable" difficulty for some scientists of materialist bent, *but the fact remains, and is demonstrated by research, that non-material mind acts on material brain* (1985, pp. 61–62,85–86).

Eccles and Robinson discussed the research of three groups of scientists (Robert Porter and Cobie Brinkman, Nils Lassen and Per Roland, and Hans Kornhüber and Luder Deecke), all of whom produced startling and undeniable evidence that *a "mental intention" preceded an actual neuronal firing—thereby establishing that the mind is not the same thing as the brain, but is a separate entity altogether* (1984, pp. 156–164). As Eccles and Robinson concluded:

> But it is impressive that many of the samples of several hundred SMA nerve cells were firing probably about one-tenth of a second BEFORE the earliest discharge of the pyramidal cells down to the spinal cord.... Thus there is strong support for the hypothesis that the SMA is the sole recipient area of the brain for mental intentions that lead to voluntary movements (pp. 157,160).

Interestingly, Eccles was not the first to document this type of independence in regard to the mind's action on the brain, as he himself conceded:

> Remarkable series of experiments in the last few years have transformed our understanding of the cerebral events concerned with the initiation of a voluntary movement. It can now be stated that the first brain reactions cause by the INTENTION TO MOVE are in nerve cells of the SUPPLEMENTARY MOTOR AREA (SMA). It is right at the top of the brain, mostly on the medial surface. This area was recognized by the renowned neurosurgeon Wilder Penfield when he was stimulating the exposed human brain in the search for epileptic "foci" (regions of aberrant activity associated with epileptic seizures) (Eccles and Robinson, 1984, p. 156).

In 1961, Canadian neurosurgeon Wilder Penfield reported a dramatic demonstration of the reality of active mind at work. He observed *mind acting independently of the brain* under controlled experimental conditions that were reproducible at will (see Penfield, 1961; 1975; Custance, 1980, p. 19). Dr. Penfield's patient suffered from epilepsy, and had one hemisphere of his temporal lobe exposed from a previous surgery. Penfield reported:

> When the neurosurgeon applies an electrode to the motor area of the patient's cerebral cortex causing the opposite hand to move, and when he asks the patient why he moved the hand, the response is: "I didn't do it. You made me do it" ….It may be said that the patient thinks of himself as having an existence separate from his body. Once when I warned a patient of my intention to stimulate the motor area of the cortex, and challenged him to keep his hand from moving when the electrode was applied, he seized it with the other hand and struggled to hold it still. Thus one hand, under the control of the right hemisphere driven by an electrode, and the other hand, which he controlled through the left hemisphere, were caused to struggle against each other. *Behind the "brain action" of one hemisphere was the patient's mind.* Behind the action of the other hemisphere was the electrode (as quoted in Koestler, 1967, pp. 203–204).

Penfield went on to conclude: "But what is it that calls upon these mechanisms, choosing one rather than another? Is it another mechanism or is there in the mind something of different essence? To declare that these two are one does not make them so. But it does block the progress of research" (p. 204). Upon closing his surgical practice, Dr. Penfield wrote:

> Throughout my own scientific career, I, like the other scientists, have struggled to prove that the brain accounts for the mind. But now, perhaps, the time has come when we may profitably consider the evidence as it stands, and ask the question: Do brain-mechanisms account for the mind? *Can the mind be explained by what is now known about the brain? If not, which is more reasonable of the two possible hypotheses: that man's being is based on one element, or on two?* (1975, p. xiii).

Penfield's final observations caused him to reflect as follows:

> This is the correct scientific approach for a neurophysiologist: to try to prove that the brain explains the mind and that mind is no more than a function of the brain. But during this time of analysis, *I found no suggestion of action by a brain-mind mechanism that accounts for mind-action….*
>
> In the end I conclude that there is *no good evidence*, in spite of new methods, such as the employment of stimulating electrodes, the study of conscious patients, and the analysis of epileptic attacks, *that the brain alone can carry out the work that the mind does. I conclude that it is easier to rationalize man's being on the basis of two elements than on the basis of one* (1975, pp. 104,114).

These are the words of a man who studied the brain for decades, and who collected and analyzed the data firsthand. Penfield (1975) concluded that the mind might very well be "*a distinct and different essence*" (p. 62). We agree wholeheartedly. A.O. Gomes wrote:

> …[R]esearch is frequently conducted as if the whole occurrences under study were ultimately nothing more than the transformations of some physiological events into others; the mental phenomena involved are either ignored or given only a secondary importance…. How can physical sense receptors affect sense? *How can a reaction in the brain condition a reaction in the mind?* How can the (often quoted!) "enchanted loom" of nerve impulses in the brain, which always weaves meaningful, but never abiding, patterns—how can this "loom" evoke such rich mental experiences as the vision of everything we see, all the sounds we hear, all the bodily sensations we may ever become aware of? (1965, p. 448,446).

In the book containing the Nobel laureate conversations on these matters, Cousins commented: "*The question naturally arises: where do mental intentions come from, what is their source, their origin?*" (1985, pp. 66–67). These "mental intentions" are truly important, as Tattersall admitted when he wrote: "Everybody can agree that a major aspect of consciousness is the ability to form intentions; and nobody will dispute that human beings spend much of their lives in this activity, however hollow those intentions may eventually turn out to be" (2002, p. 58). So how did Eccles answer the question of where these mental intentions originate? He responded: "In contrast to these materialist or parallelist theories are the dualist-interaction theories. *The essential feature of these theories is that mind and brain are independent entities…*" (Eccles and Robinson, 1984, p. 35). By way of summary, here is Dr. Eccles' view:

> The self-conscious mind is actively engaged in reading out from the multitude of active centers at the highest level of brain activity, namely, the liaison modules that are largely in the dominant cerebral hemisphere. The self-conscious mind selects from these modules according to attention and interest, and from moment to moment integrates its selection to give unity even to the most transient experiences. Furthermore, the self-conscious mind acts upon these neural centers modifying the dynamic spatiotemporal patterns of the neural events. *Thus it is proposed that the self-conscious mind exercises a superior interpretative and controlling role upon the neural events….* The present

> hypothesis regards the neuronal machinery as a multiplex of radiating and receiving structures: *the experienced unity comes, not from a neurophysiological synthesis, but from the proposed integrating character of the self-conscious mind* (1982, pp. 244–245).

It was the concept of the "self-conscious mind" to which Dr. Eccles devoted his life's research, and on which he spoke and wrote so often. In his invited lecture at the 1975 Nobel Conference, he reminded his fellow Nobel laureates:

> There is the continual experience that the self-conscious mind can EFFECTIVELY act on the brain events. This is most overtly seen in voluntary action, but throughout our waking life we are deliberately evoking brain events when we try to recall a memory or to recapture a word or phrase or to express a thought or to establish a new memory.… This hypothesis gives a prime role to the action of the self-conscious mind, an action of choice and searching and discovering and integrating.… A KEY COMPONENT OF THE HYPOTHESIS IS THAT THE UNITY OF CONSCIOUS EXPERIENCE IS PROVIDED BY THE SELF-CONSCIOUS MIND AND NOT BY THE NEURAL MACHINERY OF THE LIAISON AREAS OF THE CEREBRAL HEMISPHERE.… Furthermore, THE ACTIVE ROLE OF THE SELF-CONSCIOUS MIND IS EXTENDED IN OUR HYPOTHESIS TO EFFECT CHANGES IN THE NEURONAL EVENTS. Thus not only does it read out selectively from the on-going activities of the neuronal machinery, but IT ALSO MODIFIES THESE ACTIVITIES (1977, pp 81,82,83).

Eccles concluded by saying:

> *There must be a partial independence of the self-conscious mind from the brain events with which it interacts*. For example, if a decision is to be freely made it must be initiated in the self-conscious mind and then communicated to the brain for executive action. This sequence is even more necessary in the exercise of creative imagination, where FLASHES OF INSIGHT BECOME EXPRESSIONS BY TRIGGERING APPROPRIATE BRAIN ACTIONS (p. 87).

How would Dr. Eccles categorize himself? He certainly does not fit the description of a monist-materialist. Is he then a strict dualist? Does he consider himself a vitalist? What position does he take as a result of his fascinating, Nobel Prize-winning discoveries? In his book, *The Human Mystery*, he quelled any suspicions.

> If I should be asked to express my philosophical position, I would have to admit that I am an animist on Monod's definition. As a dualist I believe in the reality of the world of mind or spirit as well as in the reality of the material world. Furthermore I am a finalist in the sense of believing that there is some Design in the processes of biological evolution that has eventually led to us self-conscious beings with our unique individuality; and we are able to contemplate and we can attempt to understand the grandeur and wonder of nature, as I will attempt to do in these lectures. (1979, pp. 9–10).

Eventually, Sir John came to refer to himself as a "dualist-interactionist" (as did Sir Karl Popper). Eccles admitted:

> *As a dualist-interactionist, I believe that my experienced uniqueness lies not in the uniqueness of my brain, but in my psyche*. It is built up from the tissue of memories of the most intimate kind from my earliest recollection onwards to the present.… It is important to disclaim a solipsistic solution of the uniqueness of the self. Our direct experiences are of course subjective, being derived solely from our brain and self. The existences of other selves ARE ESTABLISHED by intersubjective communication (1992, p. 237).

Popper and Eccles presented their views in 1977. In his portion of that volume, Popper wrote:

> *But the human consciousness of self transcends, I suggest, all purely biological thought*.… [O]nly a human being capable of speech can reflect upon himself. I think that every organism has a programme. *But I also think that only a human being can be conscious of parts of this programme, and revise them critically* (Popper and Eccles, 1977, p. 144).

Four years before that book's publication, Eccles went on record as stating:

> I was a dualist, now I am a TRIALIST! Cartesian dualism has become unfashionable with many people. They embrace monism in order to escape the enigma of brain-mind interaction with its perplexing problems. But Sir Karl Popper and I are interactionists, and what is more, TRIALIST INTERACTIONISTS! (1973, p. 189).

[NOTE: The term "trialist" as employed by Dr. Eccles is not to be confused with the word "trialism" that John Cottingham uses in his attempt to provide what he believes is "a more realistic category" in which to put animals—as creatures that have extension and sensation, but not thought (see Carter, 2002).]

Popper (1977) discussed his view (shared by Eccles) that reality should be seen as having three different aspects, which he subsequently labeled as World I, World II, and World III. World I is the objective world of *physical entities*. World II is the subjective psychic *inner reality* of each human being. World III is the world of *human culture* (i.e., the world of ideas). Popper and Eccles both agreed that "*the self-conscious mind is an independent entity to be superimposed upon the neural machinery*"—a superimposition that can lead to a variety of interactions in the brain as it moves between Worlds I, II, and III. Continuous subjective interactions exist between World I and World II, as well as cultural interactions affecting both World I and World II.

Dr. Eccles performed numerous experiments in which nerve cells in the SMA discharged—solely as a result of mental intention—*before* the cells responsible for motor activity. He discussed on numerous occasions the scientific evidence substantiating that the mind is a separate entity from the brain—evidence that he had gathered through a lifetime of study on the brain-mind problem (see Eccles, 1973; 1979; 1982; 1984; 1989; 1992; 1994). Eccles stated: "*We are a combination of two things or entities: our brains on the one hand, and our conscious selves on the other*" (1984, p. 33).

Could Popper and Eccles be onto something here? Could there be a "world," within each human, containing a "psychic inner reality"? Jay Tolson used humans' ability to employ symbolic language (in a way that no animal can) to inquire about "a person beneath the personality."

> Using language at its most refined limit—irony—shows how we often mean something more or other than what we say. *Might that not be a tantalizing glimpse of a self beyond the mere representation of the self, a person beneath the personality? A ghost in the machine, after all?* (2002, p. 46).

Paul Davies was constrained to ask:

> Can the mind somehow reach into the physical world of electrons and atoms, brain cells and nerves, and create electrical forces? Does mind really act on matter in defiance of the fundamental principles of physics? ARE THERE, INDEED, TWO CAUSES OF MOVEMENT IN THE MATERIAL WORLD: ONE DUE TO ORDINARY PHYSICAL PROCESSES AND THE OTHER DUE TO MENTAL PROCESSES?… The only minds of which we have direct experience are those associated with brains (and arguably computers). Yet nobody seriously suggests that God, or departed souls, have a brain. DOES THE NOTION OF A DISEMBODIED MIND, LET ALONE A MIND COMPLETELY DECOUPLED FROM THE PHYSICAL UNIVERSE, MAKE ANY SENSE (1983, pp. 75,72).

While the committed monist-materialist would answer "no" to every one of Dr. Davies' questions, our research answers "yes" to each of them. With the available scientific evidence (from reputable scientists such as Penfield, Eccles, and others) which documents that mind *does* interact with matter (the brain), what other conclusion could one possibly reach? As Eccles put it:

> These considerations lead me to the alternative hypothesis of dualist-interactionism. *It is really the commonsense view, namely that we are a combination of two things or entities: our brains on the one hand; and our conscious selves on the other* (1982, pp. 88).

Feigl admitted:

> Vitalists or interactionists…hold that biological concepts and laws are not reducible to the laws of physics, and hence—*a fortiori*—that psychological concepts and laws are likewise irreducible…. The upshot of this longish discussion on the difference between the scientific and the philosophical components of the mind-body problem is this: *If interactionism or any genuine emergence hypotheses are sensibly formulated, they have empirical content and entail incisive limitations of the scope of physical determinism* (1967, pp. 7,18).

Then, not long after Feigl wrote that interactionism hypotheses, if "sensibly formulated," could have "empirical content," Sir John Eccles came along and "sensibly formulated" his dualist-interactionist theory—and then provided the "empirical content" to go along with it. And where does such "empirical content" lead? Davies inquired: "Does the notion of a disembodied mind, let alone a mind completely decoupled from the physical universe, make any sense?" We respond that it most certainly does. Eccles, Penfield, and others have shown conclusively that *mind exists independently of matter*.

The thought, then, of a "universal mind" that stands behind this Universe no longer sounds quite so far-fetched. In fact, George Wald addressed this very theme.

> I had already for some time taken it as a foregone conclusion that the mind—consciousness—could not be located. It is essentially absurd to think of locating a phenomenon that yields no physical signals, the presence or absence of which, outside of humans their like, cannot be identified.
>
> But further than that, mind is not only not locatable, it *has no location*. It is not a *thing* in space and time, not measurable; hence, as I said at the beginning of this chapter, not assimilable as science. And yet it is not to be dismissed as an epiphenomenon: it is the foundation, the condition that makes science possible….
>
> A few years ago it occurred to me that these seemingly very disparate problems might be brought together. And this could happen through the hypothesis that *mind*, rather than being a very late development in the evolution of living things, restricted to organisms with the most complex nervous systems—all of which I had believe to be true—*has been there always. And that this universe is life-breeding because the pervasive presence of mind had guided it to be so* (1994, pp. 128,129).

Dr. Wald is in good company in sensing what he called "the pervasive presence of mind." The late, distinguished astronomer from Great Britain, Sir Arthur Eddington, admitted: "The idea of a universal mind, or Logos, would be, I think, a fairly plausible inference from the present state of scientific theory" (as quoted in Heeren, 1995, p. 233). Physicist Sir James Jeans wrote:

> Today there is a wide measure of agreement which on

> the physical side of science approaches almost unanimity, that the stream of knowledge is heading towards a non-mechanical reality: the Universe begins to look more like a great thought than a great machine. *Mind no longer looks like an accidental intruder into the realm of matter; we are beginning to suspect that we ought rather to hail it as the Creator and governor of the realm of matter....* We discover that the Universe shows evidence of a designing or controlling Power that has something in common with our own minds (1930).

George Stanciu asked:

> What cause is responsible for the origin of the genetic code and directs it to produce animal and plant species? It cannot be matter because of itself matter has no inclination to these forms, any more than it has to the form Poseidon or the form of a microchip or any other artifact. *There must be a cause apart from matter that is able to shape and direct matter. Is there anything in our experience like this? Yes, there is: our own minds.* The statue's form originates in the mind of the artist, who then subsequently shapes matter, in the appropriate way.... *For the same reasons there must be a mind that directs and shapes matter in organic forms* (1987, p. 191).

Or, to quote Robert Jastrow: "That there are what I, or anyone would call supernatural forces at work is now, I think, a scientifically proven fact" (1982, p. 18).

Freeman Dyson noted:

> The mind, I believe, exists in some very real sense in the universe. But is it primary or an accidental consequence of something else? The prevailing view among biologists seems to be that the mind arose accidentally out of molecules of DNA or something. I find that very unlikely. *It seems more reasonable to think that mind was a primary part of nature from the beginning and we are simply manifestations of it at the present stage of history* (1988, p. 72).

John Beloff (1994) made a startling admission.

> The fact is that, leaving aside mythical and religious cosmologies, the position of mind in nature remains a total mystery. *It could be that there exists some sort of a cosmic mind*, perhaps co-equal with the material universe itself, *from which each of our individual minds stems and to which each ultimately returns.* All we can say is that it looks as if a fragment of mind-stuff becomes attached to an individual organism, at or near birth, and thereafter persists with this symbiotic relationship until that organism perishes.

Then, with an even bolder tact, Arne Wyller dared to ask: "*What if there existed a mind before people*...perhaps a consciousness we will one day find in another part of the Universe, perhaps a universal consciousness field: *The Planetary Mind*" (1996, p. 223).

Just think. "What if" there existed a mind before people—a "universal/planetary/cosmic Mind Who could "attach a fragment of mind-stuff" to an individual organism at birth? Just think! As Richard Heinberg (1994) remarked:

> But at least the spiritual view leaves open the door for the possibility that our explanations for biological phenomena are still incomplete in some fundamental way. To prematurely close that door might be a profound error. If we think we have essentially the whole picture of what life is and how it works, when in reality we have only a part of that picture; if our working philosophy systematically excludes certain kinds of evidence and certain kinds of explanations; and further, if we act on our philosophy in ways that have global repercussions, then could be getting ourselves into serious trouble indeed. A spiritual perspective, even in its weakest and most generalized form, would hold that *present material explanations for biological and psychological realities are necessary but not sufficient. Something else must be taken into account* (pp. 74–75).

Conclusion

That "something else" of which Heinberg wrote has intrigued almost everyone who has worked on the brain-mind problem—some to a greater degree than others. Sir Roger Penrose remarked:

> *It seems to me that there is a fundamental problem with the idea that mentality arises out of physicality*—that is something which philosophers worry about for very good reasons. The things we talk about in physics are matter, physical things, massive objects, particles, space, time, energy and so on. How could our feelings, our perception of redness, or of happiness have anything to do with physics? *I regard that as a mystery* (1997, p. 94).

So do thousands (maybe even millions!) of others. As Dennett admitted:

> It does seem as if the happenings that ARE my conscious thoughts and experiences cannot be brain happenings, but must be SOMETHING ELSE, or something cause or produced by brain happenings, no doubt, but something in addition, made of different stuff, located in a different space.... *Mind stuff...has some remarkable properties...but it is extremely resistant to definition....*
>
> Since we don't have the faintest idea (yet) what properties mind stuff has, we cannot even guess (yet) how it might be affected by physical processes emanating somehow from the brain, so let's...concentrate on the return signals, the directives from mind to brain. These, *ex hypothesi*, are not physical; they are not light waves or sound waves or cosmic rays or streams of subatomic particles. No physical energy or mass is associated with

> them. How, then, do they get to make a difference to what happens in the brain cells they must affect, if the mind is to have any influence over the body?… How can mind stuff *both* elude all physical measurements and control the body? (1991, pp. 27,28,34,35).

Good questions—which monistic materialists like Dennett cannot answer.

One thing is certain, however: the *fact* of our self-awareness—of our consciousness—is both self-evident and undeniable. The belief in an "inner self," a "personal psyche," or a "soul" is well nigh universal. Dennett also noted:

> The idea that a SELF (or a person, or, for that matter, a soul) is distinct from a brain or a body is deeply rooted in our ways of speaking, and hence in our ways of thinking…. *It is quite natural to think of "the self and its brain" as two distinct things,* with different properties, no matter how closely they depend on each other. If the self is distinct from the brain, it seems that it must be made of mind stuff. In Latin, a thinking thing is *res cogitans*…. So the conscious mind is not just the place where the witnessed color and smells are, and not just the thinking thing. It is where the appreciating happens. It is the ultimate arbiter of why anything matters. Perhaps this even follows somehow from the fact that the conscious mind is also supposed to be the source of our intentional actions (1991, pp. 29,31).

Jerome Elbert wrote in agreement: "The soul belief is so basic in our culture that, through ordinary communications, most of us come to believe that a network of neurons cannot, by itself, generate our thoughts and awareness of the world" (2000, p. 217).

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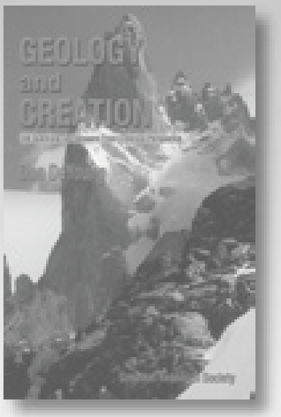
[Authors' Note: This article is an abbreviated discussion of this topic. A more complete treatment may be found in: Harrub, Brad and Bert Thompson. 2003. *The truth about human origins*. Apologetics Press, Montgomery, AL.]



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The Geology of the Oklahoma Basement

John K. Reed*

Abstract

The basement in Oklahoma consists of igneous rocks, mostly granitic, whose surface is a profound erosional discontinuity overlain by marine sediments. Basement deforming tectonism was active in the southern part of the state forming the Southern Oklahoma Aulacogen, which is commonly interpreted as a Cambrian rift. This feature contains thick sequences of bimodal igneous rocks with unusual sheet granites. The lithologic and erosional discontinuities that mark the transition from the igneous crust to overlying Paleozoic marine sediments probably represents the pre-Flood boundary, and the tectonism of the Southern Oklahoma Aulacogen may reflect activity at the onset of the Flood in the southern midcontinent.

Introduction

The success of creationist geology will depend on the integration of modern geological data, currently obscured by multiple layers of uniformitarian interpretation, into a framework consistent with biblical history. Progress has been slowed by the regrettable practice of prematurely building grand explanatory models absent sufficient data, and the need exists for a more measured approach. The task is challenging. Catastrophists are few, uniformitarians many. We must work against a flood of contrary interpretations, understanding that the uniformitarian paradigm provides a path of least resistance in assimilating and publishing new information. In addition to these obvious hurdles, creationists must subject themselves to more restrictive interpretive constraints (Reed and Froede, 1997). For example, vertical successions of strata must be integrated (in a short time frame); there is no luxury of millions of years of erosion or nondeposition to account for an apparent discontinuity inserted between two formations of quite different properties. An important initial consideration in effectively reworking geological data is the determination of an appropriate scale of study. I believe that work done on basinal to regional scale can provide optimum progress as long as the goal of interpretive continuity is maintained from one project to another (Reed, 2000; 2002c; 2003; 2004). This approach is applied here: to follow the data logically, this series will begin with the basement and work stratigraphically upwards to the present day surface for the state of Oklahoma.

In almost all of the state, the basement is covered by deformed sedimentary sequences that form the present day geologic provinces of Oklahoma (Figure 1). The thickest sedimentary sequences are offset by exposed basement at the juxtaposed Wichita Uplift and Anadarko Basin in Southwestern Oklahoma. The most complexly deformed strata are found in the southeastern Oklahoma Ouachita overthrust province. Northern Oklahoma's basement is covered by relatively thin undeformed sediments. In each province, the extent, direction, and timing of basement tectonics are a crucial influence on the overlying strata.

> Knowledge of the basement is fundamental to understanding the evolution and geological history of a region. The way the "cover" has interacted with its substrate, the basement, determines to a large degree how the geological processes of the Earth's surface and upper few kilometers of the crust unfold. Fluid flow through the upper crust (formation of petroleum reservoirs, ore deposits, regional-scale aquifers, etc.) is ultimately almost always tied to basement-cover interactions. (Gilbert, 2002, p. 31).

One advantage of studying Oklahoma geology is the large amount of published information available. Base-

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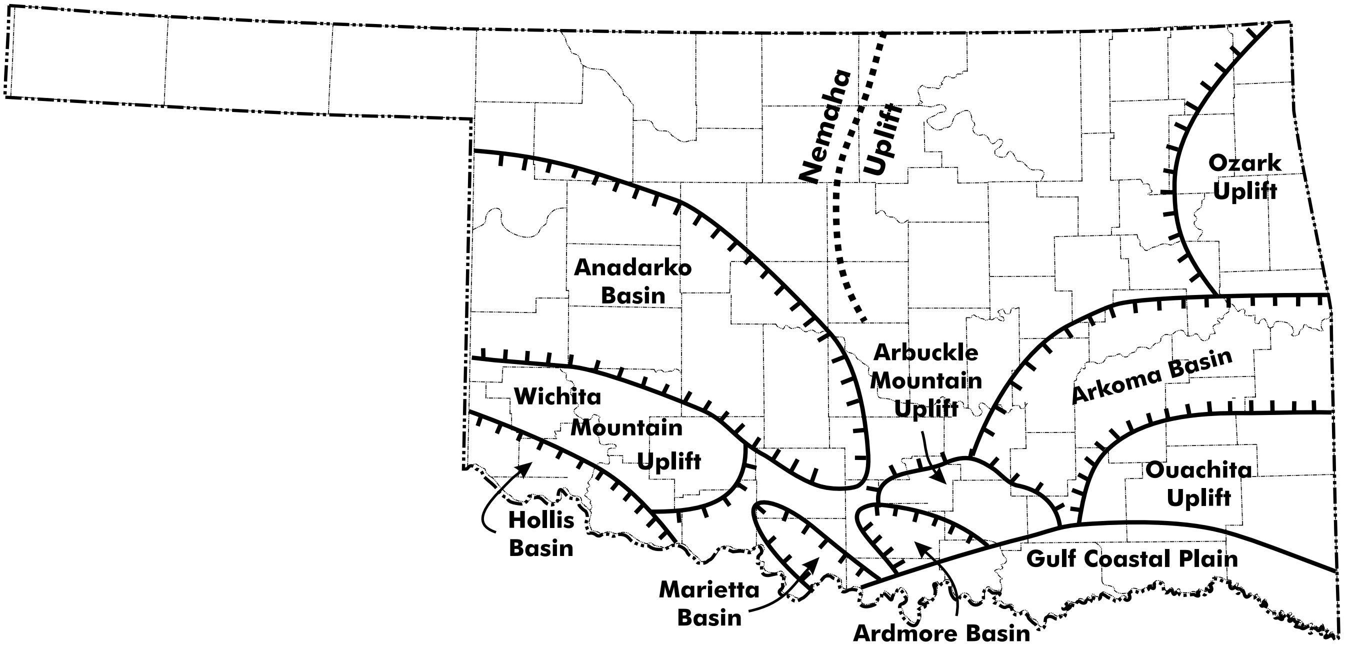

Figure 1. Geologic provinces of Oklahoma. Modified from Northcutt and Campbell (1995).

ment rocks have been extensively investigated in outcrop, geophysically (seismic, gravity, magnetic, and well logs), and in cores. A mature oil and gas industry has fueled many of these studies, and much information is available from the Oklahoma Geological Survey http://www.ogs.ou.edu/. Of the more than 260,000 oil and gas wells completed in Oklahoma, many have penetrated into basement rock. Outcrops exist in several locations in southwestern Oklahoma (see http://www.ogs.ou.edu/education/intgeol/2precam.htm) and have been extensively studied.

> In Oklahoma, two well-known geologic windows, the Arbuckles and the Wichitas, expose for study key aspects of the basement of the Midcontinent. (Gilbert, 2002, p. 31)

Outcrops in northeastern Oklahoma are limited to exposures of the Spavinaw Granite in five hills in Mayes County (Denison, 1981).

This paper will address the geology of the Oklahoma basement by first describing it in context; the basement of the midcontinent region. Then it will describe the various basement provinces and terranes present beneath the state and offer an interpretation of those features in the context of the Genesis account.

Geology of the Midcontinent Basement

Some knowledge of the surrounding regional Precambrian[1] basement helps to place the features of the Oklahoma basement in context. Detailed information of the midcontinent basement is available in Reed (1993). Uniformitarian interpretations of the basement appear to rest on two fundamental assumptions: (1) the existence of joined crustal terranes of distinct origin and history, defined primarily by isotopic dating, and (2) plate tectonics. The extent to which such interpretations might prove useful to creationists, I leave to the reader.

Topographically, the basement surface in the midcontinent dips to the south from surface exposures in Minnesota and Wisconsin (where exposed basement extends even farther north and east to the Canadian Shield) to deeply buried rocks in the Anadarko-Arkoma-Ardmore basins at the north boundary of the Wichita uplift and Ouachita thrusts (Sims, 1990). Depth to crystalline rock in the Anadarko Basin ranges up to ~12,000 m (~40,000 ft) (Dutton et al., 1982; Johnson et al., 1989). This south-dipping surface is interrupted by cratonic basins (e.g., Illinois, Michigan, Salina-Forest City), most of which supposedly formed during the Paleozoic.

There are many uniformitarian studies interpreting the early history of the midcontinent Precambrian crust. Increasing acquisition of geophysical data has revealed a structural complexity not previously expected. Protero-

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[1] The use of uniformitarian stratigraphic names is used for convenience of reference only. No age information should be inferred.

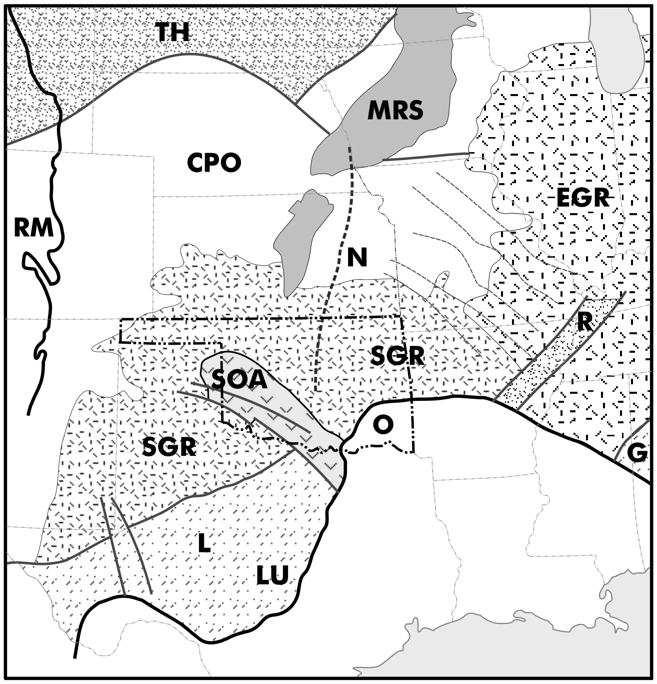


Figure 2. Basement provinces of the North American Midcontinent. RM = Rocky Mountains; TH = Trans-Hudson provinces; G = Grenville Province; L = Llano Province; LU = Llano Uplift; SOA = Southern Oklahoma Aulacogen; CPO = Central Plains Orogen; MRS = Mid-continent Rift System; SGR = Southern Granite Rhyolite Province; EGR = Eastern Granite Rhyolite Province; R = Reelfoot Rift.

zoic fold and fault zones indicate an episode of extension that fractured the craton into tectonic blocks that would later serve as zones of weakness for Phanerozoic inversion, transpression, and transtensional faulting (Marshak and Paulsen, 1996; Marshak et al., 2000). Thomas and Baars (1995) connected many of these into a proposed line of fault systems and associated sedimentary basins extending from the Bahamas to the Olympic Peninsula. They noted three specific periods of activity: >1 Ga; at the Precambrian-Cambrian boundary, and during the late Paleozoic to early Mesozoic. Kinsland (1995) proposed an 800-km (500-mi) slip transform fault running from Florida to Montana based on a perceived offset of anomalies in the national gravity map. Although details differ, most uniformitarians agree that Precambrian history saw the gradual development of the continent by accretion during the Archean and Proterozoic, based on isotopic dates (Van Schmus et al., 1993; 1996) and inferred plate tectonic history.

Geologists have classified basement rocks into several regional provinces (Figure 2). Basement rocks in the southern midcontinent include the Southern and Eastern granite-rhyolite provinces and the Wichita Magmatic Province. Sm-Nd age dates (Van Schmus et al., 1996) have led researchers to believe that much of the granite-rhyolite provinces existed as a veneer covering the older crust of the Central Plains orogen. The basement in Oklahoma is predominantly the Southern Granite-Rhyolite Province, a younger unit (1.37 Ga) of epizonal granite and rhyolite. Descriptions come from outcrops in northeastern Oklahoma, and from numerous wells drilled in Oklahoma, Missouri, Kansas, and Texas. Outcrop samples include granophyre (very finely crystalline granite), granite, granodiorite, and equivalent volcanic rocks. These rocks are chemically and petrographically similar to the Eastern Granite-Rhyolite Province, but are dated at a younger age than those 1.47 Ga rocks.

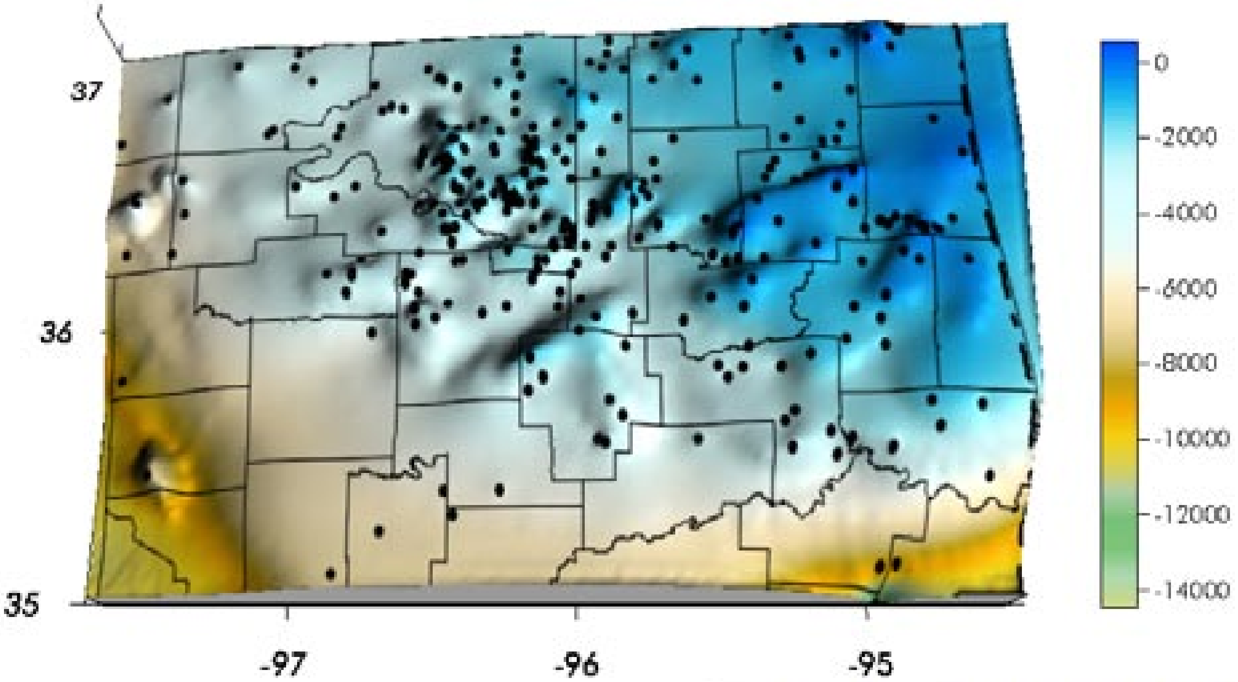
Oklahoma Basement Provinces

Three distinct basement provinces are recognized in Oklahoma: the Southern Granite Rhyolite Province, the Southern Oklahoma Aulacogen, and the Ouachitas (Gilbert, 2002). The basement beneath the Ouachitas (Figure 1) is poorly known, but currently considered transitional to the Gulf of Mexico. While it is significant to the tectonic history of the region (late Paleozoic deformation in the state is tied to Ouachita thrusting) discussion of the Ouachita Province is best left to another paper. The terranes of the Southern Granite-Rhyolite Province are somewhat better known and those of the Southern Oklahoma Aulacogen have been intensely studied for many years due to the economic importance of the geology in southern Oklahoma. Thus, the bulk of this paper will focus on the Southern Oklahoma Aulacogen, but the reader should remember that this emphasis is driven by data.

Southern Granite-Rhyolite Province

An extensive petrographic, isotopic, and geochemical study (Dennison, 1981) using numerous cores from wells spread over 64,000 km^2 (25,000 mi^2) subdivided the Southern Granite-Rhyolite Province basement in northeastern Oklahoma into four distinct rock units and three terranes. The basement over much of this area is less than 1,000 m (3,000 ft) below ground surface, with outcrops occurring in only one small area near Spavinaw, Oklahoma. Relief on top of the basement surface (Figure 3) is significant, up as much as ~450 m (1,500 ft) in one township (Denison, 1981). Significant well control has allowed the identification of four major rock units (Figure 4), composed of rhyolite porphyry and its equivalent tuff (~65%), metarhyolite (~33%), and minor andesite (~2%).

Denison (1981) identified and mapped (Figure 4) four



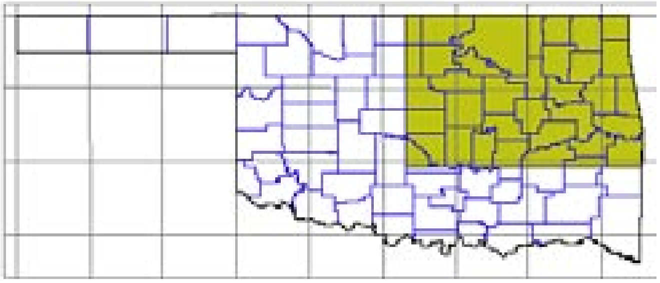


Figure 3. Surface of the basement in northeastern Oklahoma. Dots represent well control. Based on data from Denison (1981). Vertical scale in feet relative to mean sea level.

major rock units in northeastern Oklahoma (the historical interpretations are his).

Washington Volcanic Group. The Washington Volcanic Group is named for Washington County, and consists of rhyolites and a band of metarhyolite adjacent to the Central Oklahoma Granite. The greatest known thickness is 145 m (475 ft), based on well penetration, but the rhyolite is thought to achieve a much greater thickness. The metarhyolite has been converted to hornfels (high-temperature, low-pressure metamorphic rock of uniform grain size formed by contact metamorphism), but the 56 km (35 mi) width of the band argues against contact metamorphism. Regional metamorphism would be needed to alter such a large unit, but the rocks show no evidence of high pressure, shearing, or high water content.

Spavinaw Granite Group. The Spavinaw Granite Group was named for granite that outcrops in five small hills in Mayes County that is remarkably similar to a wide band of granite covering 19,000 km^2 (7,300 mi^2) (Figure 4). Denison (1981) notes that there is greater uniformity in the Spavinaw Granite than in the much smaller Wichita granite bodies in southwestern Oklahoma, which suggests that it is a single sill, although it is considered by many to be too large for one sill. The Spavinaw Granite is classified as a micrographic granite porphyry.

Osage Microgranite. The Osage Microgranite is an extremely homogeneous circular intrusion of ~830 km^2 (~320 mi^2) in central Osage County. The rock has a distinctive texture; quartz phenocrysts are shaped like spicules (rods). As Denison (1981, p. 16) noted: “Only a special intrusive process could have caused a distinct rock type to be so uniform petrographically over such a wide area.” Because of the petrographic uniformity, Denison interpreted the Osage body as a thin sill intruded into rhyolite which was later eroded away. However, he notes that there are no contact effects in the surrounding rhyolite.

Central Oklahoma Granite Group. The Central Oklahoma Granite Group is a mesozonal granite with slightly younger isotopic dates than the other three. Its petrography led Denison (1981) to conclude that it

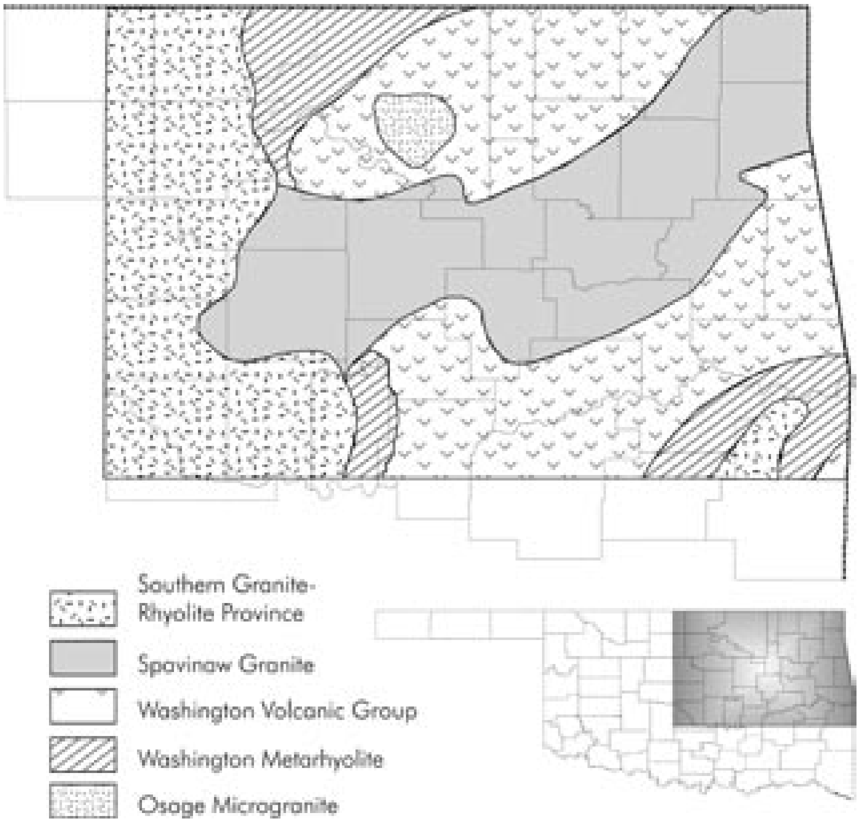


Figure 4. Basement lithologies in northeastern Oklahoma. Modified from Denison (1981).

was a composite of multiple batholiths that had been emplaced at greater depths than the Northeast Province rocks and subsequently eroded more deeply than those rocks. It is considered to be the youngest of the northeastern Oklahoma basement units since the Washington volcanics have been metamorphosed at their contact with the Central Oklahoma Granite Group.

The structure of the northeast basement is dominated by the Spavinaw Arch, coincident with the trend of the Spavinaw Granite (Figure 4). Denison (1981) assumed that rhyolite (presently mapped to both the north and south of the granite) once covered the Spavinaw Granite and was later eroded as the arch was uplifted. Structural evidence is not sufficient to determine whether the arch formed by folding or faulting. Areas to the north and south of the Spavinaw Arch with Washington Group rhyolite are interpreted as basement synclines. Likewise, the Nemaha Uplift is interpreted as having been active prior to Cambrian sedimentation because rhyolite is absent on that structure. Denison (1981) suggests that Paleozoic movement was a reactivation of earlier basement structuring.

Denison (1981) notes several contrasts between the basement in northeastern Oklahoma and southwestern Oklahoma. The southwestern rocks are richer in silica, and have basalt and diabase dikes that are absent in the northeast. All of the northeast basement units have been isotopically dated at ~1,280 Ma (Denison, 1981). Because they are considered a shallow veneer over unknown deeper rocks, they are considered less eroded than surrounding rocks.

Southern Oklahoma Aulacogen

The Southern Oklahoma Aulacogen (SOA) is defined as "the rift of apparent Cambrian age which now trends WNW from about the Dallas area to the Amarillo area." (Gilbert and McConnell, 1991, p. 110). It includes the southernmost part of the present-day Anadarko Basin (the deepest sedimentary trough in North America), the Ardmore and Marietta basins, the Arbuckle uplift and the Wichita uplift (Northcutt et al., 2001; Figure 1). It was first named by Shatski (1946), but the name, "Southern Oklahoma Geosyncline" was also used for many years (Lindsay and Koskelin, 1991). "Aulacogen" is a tectonic term for any deep sedimentary basin believed to be a failed arm of a triple junction. Aulacogens are usually fault bounded and show multiple cycles of movement and sedimentation. In spite of the plate tectonic, uniformitarian connotations, "Southern Oklahoma Aulacogen" is the most commonly used term in the literature and will be used throughout this paper descriptively, without implying any plate tectonic or uniformitarian interpretation.

Gilbert and McConnell (1991) note five ways in which the extent of the SOA has been identified (Figure 2). These include: (1) gravity and magnetic anomaly signatures, (2) the distribution of Cambrian basement based on isotopic dating, (3) the distribution of mafic basement rocks, (4) the distribution of faults and uplifts, and (5) thickening of Cambrian and Ordovician sediments into the SOA, approximately 3–4 times their cratonic thickness. All of these criteria are centered around the present day Wichita-Criner-Amarillo uplift. This implies that the mafic basement rocks comprised the rift fill, and later silicic volcanics overlapped the rift boundaries. Rock relationships suggest that the rift formed a half graben with most of its extension to the north. The only exposed boundary of the rift is

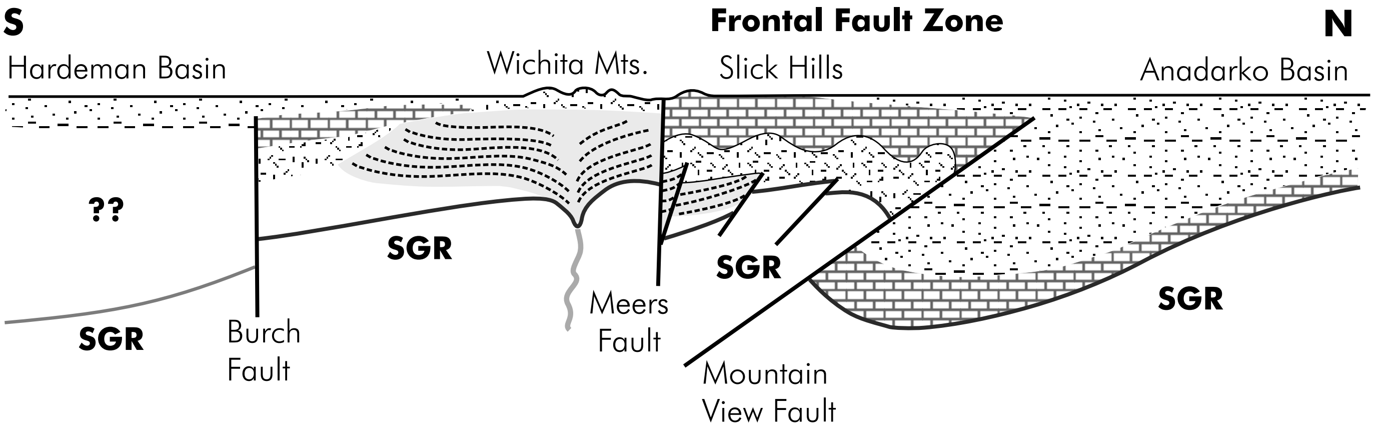


Figure 5. Schematic north-south cross section of the Anadarko Basin, Wichita Uplift, and Hardeman Basin. Modified from Gilbert and Denison (1993).

the Washita Valley Fault in the Arbuckle Mountains, which offsets Precambrian mesozonal granite outside the aulacogen with the Cambrian Carlton Rhyolite (Ham, 1973). Precambrian mesozonal granites (1,300–1,600 Ma) surround the SOA.

The SOA basement is exposed in outcrop in the western Arbuckles (Fay, 1989) and in the Wichita Mountains in a trend that extends ~100 km (62 mi) from Fort Sills, Oklahoma in the southeast to Granite, Oklahoma in the northwest. Outcrops are also exposed in the Slick Hills on the northeast side of Wichita Mountains, surrounded by a thin mantle of lower Permian sediments (Gilbert, 2002). The SOA trends N60°W (Donovan, 1995). The Wichita Mountains are an uplifted and broken crustal block that used to be the basement of the SOA and now form the southern boundary of the Anadarko Basin. The mechanical integrity of the block may be due to the strength of the igneous fill, underlain by dense mafic rocks such as the gabbros of the Glen Mountains Layered Complex.

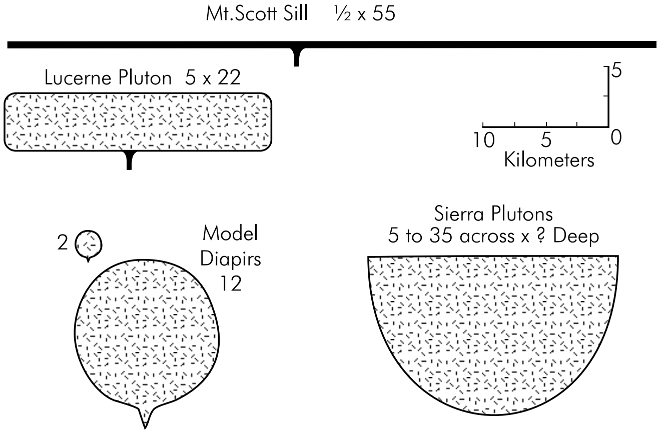


Figure 6. Dimensions of granitic plutons as compared to the Mount Scott sill in the Wichita Mountain Granite. Modified from Gilbert and Denison (1993).

Gilbert and McConnell (1991) cited the distribution, composition, and interrelationships of igneous fill of the SOA to infer its tectonic history prior to Paleozoic sedimentation. They noted that the timing between the igneous activity and the earliest marine sandstone was relatively short, based on isotopic dating of the granites. They concluded that the SOA was a rift with bimodal rocks filling its expanding volume. The lack of rift sediments contrasts sharply with many other known rifts, and Gilbert and McConnell (1991) speculate that this implies uplift prior to igneous activity. Crustal extension estimates have been made based on (1) fault geometry, (2) crustal thinning, and (3) mass-balance calculations. These estimates run between 5 and 21 km (3–13 mi), in the direction N30°E. (Gilbert and McConnell, 1991; Donovan, 1995).

Outcrop and geophysical evidence suggest that the mafic intrusions extend to the southern boundary of the SOA and are covered by a veneer of silicic rocks (Figure 5). The thickest parts of the Carlton Rhyolite are found in the less uplifted areas of the frontal fault zone. Extension in the SOA is based on structural and petrologic evidence. Rifting, magmatism, and erosion are all considered part of the formation of the SOA. The sheet nature of the granites (Figure 6) argues for extension because granite intrusions would probably be more equant in a compressional regime (Gilbert and McConnell, 1991).

Gilbert and Denison (1993) summarized the SOA and its igneous fill. Isotopic dating places the rift fill in the early Cambrian; the only igneous rocks of that era in the midcontinent. The igneous rocks are bimodal (mafic and felsic), similar to those of the Midcontinent Rift System.

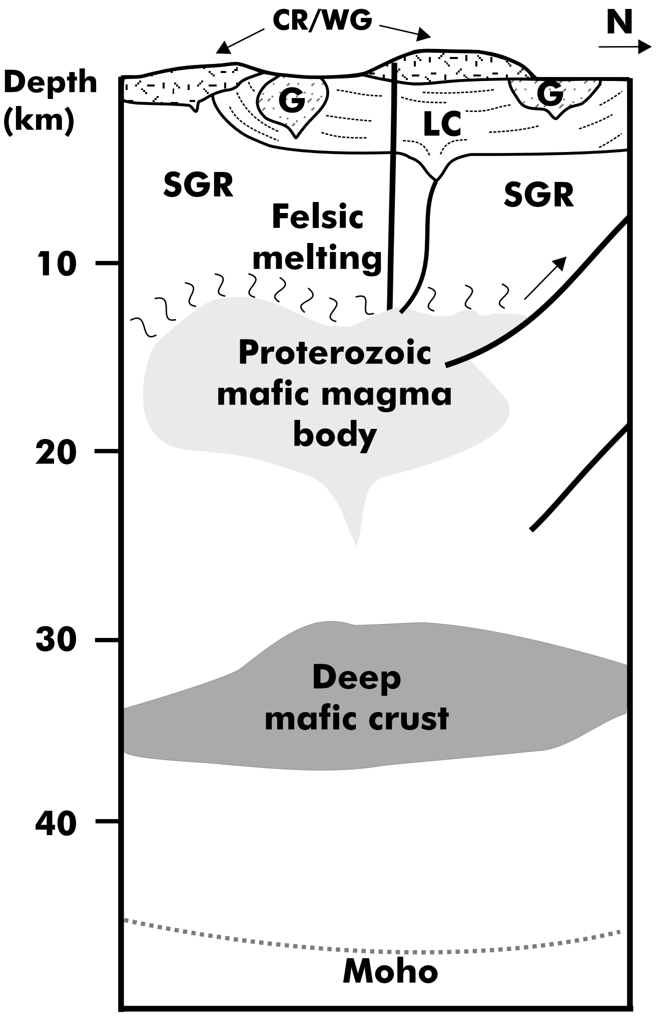


Figure 7. Diagram of crust beneath Wichita uplift showing effect of hypothesized deep crustal intrusion on both mafic and felsic igneous activity. Modified from Gilbert and Denison (1993).

They consist of sheet granites and rhyolite overlying a layered mafic complex and intruded gabbros. Late stage diabase dikes cut all of the other units. The only sediment associated with the SOA rifting is the Meers Quartzite, found above the mafic fill and overlain and metamorphosed by granite. Cambrian igneous rocks range up to 6,100 m (20,000 ft) thick on the Wichita Uplift and are considered to have ranged between 1,500–6,100 m (5,000–20,000 ft) in the deep basin (Johnson, 1989).

The Tillman Metasediment Group is considered by some to be pre-rift (Lindsay and Koskelin, 1991), but McBee (1995) believes that it postdates tectonism and preceded igneous activity. He speculates that Tillman sediments were deposited in the graben formed by the left lateral movement along the Muenster and Washita Valley faults. Rift fill units and their relative positions are shown in Figure 5. Although a variety of subdivisions have been made in the field, the SOA igneous rocks shown here are more broadly classified. Based on both field relationships and isotopic data, these units are presented from oldest to youngest.

Raggedy Mountain Gabbro Group

The Raggedy Mountain Gabbro Group includes the Glen Mountain Layered Complex and the Roosevelt Gabbros. The Glen Mountain Layered Complex is the oldest exposed Cambrian igneous unit and is believed to represent the onset of rifting. The complex is a layered anorthositic intrusion, with alternating layers of plagioclase and olivine. It is estimated to cover between 975 and 2,000 km^2 (375–975 mi^2) with 1–2 km (0.6–1.2 mi) of its vertical section exposed in outcrops. Some well-laminated layers imply seismicity during the intrusion (Gilbert and Denison, 1993). Cooper (1991) divided the Glen Mountain Layered Complex into three major cycles, representing individual magma pulses.

The Roosevelt Gabbro consists of several large cylindrical intrusions and numerous smaller dikes and sills into the Glen Mountain Layered Complex (Cooper, 1991). They have been observed in five small outcrops (the largest is 24 km^2 or 9 mi^2); as a large cylindrical intrusion; as dikes up to 3 m (10 ft) thick; and sills up to 60 m (200 ft) thick (Cooper, 1991). The gabbros were derived from hydrous tholeiitic liquids, with primary biotite and amphibole. The Glen Mountain Layered Complex is intruded by two sets of mafic dikes and the felsic Cold Springs intrusions, which include tonalite, granodiorite, and local granite as laccoliths and sills up to 70 m (225 ft) thick and 1.6–3.2 km (1–2 mi) across (Cooper, 1991). Cold Springs intrusions are common along preexisting sills and dikes.

Navajoe Mountain Basalt-Spilite Group

A poorly known basalt and spilite sequence that reaches a drilled thickness of 320 m (1,050 ft) (Ham, 1973), is considered an extrusive equivalent of the gabbroic intrusions. It is composed of spilitic basalts and tuffs. However, little is known about this unit at present.

The Carlton Rhyolite Group

The Carlton Rhyolite Group (locally called the Colbert Rhyolite in the Arbuckles) is known from five outcrops in the Wichita and Arbuckle Mountains. The lavas, pyroclastics and agglomerates were deposited on an unconformity on top of the gabbros of the Glen Mountain Layered Complex and the Roosevelt Gabbros. Exposures of the rhyolite cover ~260 km^2 (~100 mi^2) (Donovan and Stephenson, 1991). Donovan (1995) reported that 1,100 m (3,600 ft) of the Carlton Rhyolite is exposed in the Slick Hills region of the Wichita Mountains as a monotonous, thick-bedded sequence of lava and pyroclastic flows. However, the reported a maximum thickness of the Carlton is nearly 1,500 m (5,000 ft) (Ham, 1973), and Fay (1989) noted a drilled thickness of 1,370 m (4,500 ft) and an estimated thickness of 2,290 m (7,500 ft) for the equivalent Colbert Rhyolite at the top of the East Timbered Hills in the Arbuckle Mountains along Interstate 35. The rhyolite probably once covered nearly 39,000 km^2 (15,000 mi^2), although much of this was removed by later erosion (Denison, 1973). McBee (1995) attributed the Carlton Rhyolite and associated intrusives to the creation of a release bend graben formed by lateral slip along major faults.

The unconformity between the Carlton Rhyolite and Cambrian sediments shows significant relief with hills up to 300 m (1,000 ft) high. Donovan and Stephenson (1991) note that this relief implies rapid subsidence of the volcanics relative to the surrounding craton.

Wichita Granite Group

The Wichita Granite Group is a series of sheet granites (Gilbert, 2002), named for their geometry (Figure 6). The sheet style of the granites is determined from gravity anomalies, the apparent lateral extent of some of the granites (up to 55 km or 34 mi), regional subhorizontal granite body floors, abundant cooling columns, and evidence of quenching. Individual sill thickness ranges up to 0.5 km (1,640 ft). This geometry combined with the known high viscosity of granite magma suggests emplacement through fissures or faults instead of pipes, in turn implying intrusion during rifting. Although eleven different granites have been identified, the Mount Scott Granite is the most widespread, dated at 534 Ma (Gilbert, 2002). Chemically, these rocks are A-Type granites, characterized by low calcium, aluminum, mafic and feldspar trace elements; and high iron and potassium.

Uniformitarians agree that the granites were emplaced near the surface, beneath the Carlton Rhyolite, based on their granophyric texture, shallow crustal inclusions, and mineralogical indications of low pressure, high temperature conditions. The presence of rhyolite dikes indicates that erosion and/or block rotation occurred immediately after emplacement of granites because if the overburden had not been decreasing, the rhyolite dikes would have granitic texture (Gilbert and McConnell, 1991). Most granites are high-silica, hypersolvus, quartz-perthite rocks. Mafic constituents include hornblende, biotite, and magnetite. The melt depth has been estimated at 12–15 km (7.5–9.3 mi) (Gilbert and Denison, 1993) and granite source chemistry varied from west to east, based on changes in their silica content.

Minor Igneous Rocks

A variety of hybrid igneous rocks are found near or at the contact between the granites and gabbros. These have interesting mineralogy, but make up a very small fraction of the SOA fill. Rhyolite dikes also occur but are not common, and late diabase plugs and dikes are widely scattered.

Gilbert and Denison (1993) proposed six steps in the evolution of the SOA (Figure 7).

1. Latest Proterozoic to early Cambrian (~550 Ma) rifting related to the opening of the proto-Atlantic ocean. "The limits of the rift are not clear." (Gilbert and Denison, p. 313). Gilbert favors just the Wichita, Mountain area, but Denison thinks it underlies the Andarko basin, too. Arbuckle Granites form a northern boundary, but the southern boundary is buried and they consider it "seismically defined…[by]…enigmatic layered rock" (p. 313). The N60°W tectonic trend is reflected as far away as Colorado.
2. Rifting caused the rise of basaltic magma from the mantle to the depth of ~15 km (~9 mi). Some of the magma ponded at shallower levels to form the Raggedy Mountain Gabbro Group. Mineralogy of the gabbros suggests shallow emplacement. There was tilting during the emplacement: the younger Roosevelt Gabbros are not parallel to the older Glen Mountain Layered Complex. The area was then uplifted and eroded to expose the shallow gabbros. The layered complex was tilted by as much as 15°. The surface was deeply weathered with a relief of several hundred feet over 100 million years.
3. Heat from the cooling basaltic body at 15 km (9 mi) melted roof rock of the Southern Granite Rhyolite Province to form a felsic melt that was first extruded as the Carlton Rhyolite Group across the surface of the gabbro in the Wichita Mountain area and over a thick basalt sequence just to the north. The Rhyolite spread over 39,000 km^2 (15,000mi^2) primarily as fissure eruptions centered just south of the Raggedy Mountain Gabbro Group. Present day rhyolite thickness may reach ~2,300 m (~7,500 ft). Simultaneously, granite was intruded beneath the rhyolite along the rhyolite-gabbro erosional surface as thin sills. The granitic magma was dry and used the same feeder system as the rhyolites.
4. The final igneous activity of the area was the emplacement of diabase dikes at the rift margin both inside and outside.
5. Paleozoic seas transgressed and deposited thick sediments. The first Cambrian sediments are dated at 520 Ma.

6. Two-stage uplift in the late Paleozoic exposed and eroded the igneous core, creating the present arrangement of basins and uplifts.

Discussion

A biblical earth history must reject the uniformitarian classification of basement rocks by their isotopic dates and purported uniformitarian plate tectonic affinity. How then are they to be classified? The most obvious method is to first determine their relationship to the Genesis Flood, if any, and if not, explain their features by the events of the creation week and subsequent antediluvian geologic processes (probably minor). It is worthwhile to remind ourselves that the creation events are by definition largely outside of the scope of scientific study. This is one reason why creationists must insist that natural history and natural science are two distinct enterprises.

Austin and Wise (1994) provide a series of criteria to determine the basal Flood boundary. They claimed that a combination of several of five discontinuities was diagnostic of the pre-Flood boundary. These included: (1) a mechanico-erosional discontinuity, (2) a time discordance, (3) a tectonic discontinuity, (4) a sedimentary discontinuity, and (5) a paleontological discontinuity. Over much of Oklahoma, the first and fourth are present, and within the SOA, the third is present, too. Although it is quite obvious, there are two characteristics of the Oklahoma basement that provide clues to the origin of its features: (1) the dramatic lithologic change from widespread igneous rocks (predominantly granite) to overlying Phanerozoic sediments and (2) the erosional contact between those two groups.

As obvious as these features are, uniformitarians generally downplay this transition because it points to a sharp discontinuity in geologic processes that does not conform to their approach to natural history. The break between igneous and metamorphic basement and overlying sediments has long been recognized as a global phenomenon, and even according to uniformitarian history, the existence of sedimentary rocks prior to this unconformity is restricted in spatial extent and lithologic diversity. The hiatus becomes ever clearer when one breaks away from the framework of the geologic column, evaluates the physical evidence, and sees many “Precambrian” sedimentary rocks having exactly the same character as “younger” rocks, which also rest on top of the eroded basement surface. For example, thick arkosic clastic sediments in basins adjacent to the Midcontinent Rift System can be interpreted as very early Flood deposits, since the marine inundation of the continents would not have happened immediately (Reed, 2000).

The eroded basement surface in northern Oklahoma is probably the pre-Flood/Flood boundary. It marks a significant erosional and lithologic discontinuity covered by widespread marine sedimentation. The depth of erosion into the igneous rock is unclear. There are some indications, but an answer requires assumptions that cannot be demonstrated. The Central Oklahoma Granite Group is differentiated from other units in northeastern Oklahoma by its mesozonal texture. If crystal size (epizonal vs. mesozonal) indicates the depth of crystallization, then that body may show a greater depth of erosion than the epizonal rocks. However, a simple correlation between crystal size and depth of erosion may not be warranted. Likewise, differential erosion is concluded based on the absence of rhyolite over the Spavinaw Arch, but this assumes that rhyolite was present over the arch initially.

The irregular topography of the basement surface (Figure 3) suggests one or more of several possibilities about the top basement hiatus: (1) erosion was not by sheet flow, (2) small-scale differential uplift occurred during erosion, or (3) differential erosion was caused by laterally varying rock properties. The lithologic similarity seen in core samples argues against the latter. Oard (2001) describes the transition from widespread sheet erosion to channelized erosion during the recessive stage of the Flood. Conversely, channelized erosion would be expected during the early days of the Flood on continental interiors, prior to inundation by the marine front of the Flood. The closest modern analogy would be flash flooding, only on a much larger scale.

Reed (2002a; 2002b) has documented the challenge to uniformitarianism offered by the presence of any large hiatus in the rock record. Although such gaps are explained away, uniformitarians do not appear to grasp that the lack of physical evidence (the rock record) decreases confidence in their interpretations. Though the absence of large portions of the rock record does not itself invalidate the uniformitarian position, it does point out the weakness of a positivist approach to natural history. The supposed time interval between the basement and the first Cambrian sediments of the Reagan Formation ranges up to almost 900,000,000 years (Denison, 1997; Gilbert, 2002). Please note that this interval is almost twice the extent of the Phanerozoic, which constitutes the overwhelming bulk of the rock record of North America. Philosophical uniformitarianism cannot survive large demonstrable irregularities in the historical record (Reed, 1998).

Uniformitarian difficulties with the time discontinuity between the basement and overlying sediments are exacerbated by the on-off-on-off problem of structural motion and deformation. Geologic literature is replete with references to “reactivation” of faults and tectonic features and Oklahoma is no exception. Although the concept of structural motion occurring preferentially along existing zones of weakness makes sense, crustal dynamics are not quite as simple. A zone of weakness is only a necessary cause of motion, not a sufficient cause, and the question is not so much why the motion reoccurs along a weak plane, but why the motion reoccurs at all. Plate tectonics purports to provide a continuous impetus throughout the crust, but plate tectonics also results in significant changes in the location and orientation of any given preexisting fault over time. In other words, a N-S oriented fault that moved at one time may be oriented E-W at some later time due to plate rotation. Do primary stress axes rotate in symphony with faults?

An advantage of the creationist perspective is its dismissal of the long intervening times of quiescence between motion on faults. Strain responses along a fault may be intermittent, even when the stress is constant. A "hesitation" along a fault combined with irregular, rapid sedimentation may allow for the appearance of fault reactivation, but only if the time of sedimentation is assumed to take millions of years. Likewise, creationists should begin to look at examples of inversion as a part of one complete episode, not a new tectonic movement initiated millions of years later. Southern Oklahoma provides an opportunity to evaluate both approaches. For example, the Meers Fault, located in the frontal fault zone (Figure 6) was active during Pennsylvanian and Permian time, but shows both Quaternary and recent movement. This raises the question, what makes more sense, recurrent small motion after a few thousand years or a few hundred million?

In addition to the timing of structuring, catastrophist views address its extent, too. If a global Flood occurred, one consequence would be megaregional to continental scale tectonism. As geological knowledge increases, it has become clear that large-scale structuring has occurred. Thomas and Baars (1995) proposed a structural connection between northwest trending structures in North America from Florida to Washington State: a trend they named the Paradox Transcontinental Fault Zone. They note nine distinct zones and three distinct periods during which deformation occurred: >1 Ga, at the Precambrian-Cambrian boundary, during the late Paleozoic, and in the early Mesozoic. A biblical model would predict active tectonism during the creation week, at the onset of the Flood, and later during tectonic readjustments following the Flood highstand. Additional tectonism would be expected following the Flood and throughout the ice age as the land masses adjusted to their new subaerial state. Periods of predicted elevated geologic energy were noted by Reed et al. (1996).

Uniformitarians provide a general sequence of events at the SOA that can be accommodated within a Flood model. Like other such features, the key difference is in the timing of the events. Both groups would agree that early tectonism led to the formation of the SOA and its igneous fill, followed by subsidence, as evidenced by thickening Paleozoic sedimentary units into southwestern Oklahoma. Later tectonic inversion led to the formation of the Anadarko Basin and the Wichita uplift, and the associated smaller basins and uplifts (Figure 1). What does the field evidence demonstrate regarding the timing of these events? The rock record suggests much less time than proposed by uniformitarians.

First, unlike modern examples and most ancient ones, the SOA does not show evidence of rift basin sedimentation. There are only two sedimentary bodies (both metamorphosed) associated with the SOA. The first is the Tillman Metasedimentary Group located at the southern end of the rift and the Meers Quartzite, located on top of mafic rocks and beneath late sheet granites. Most examples of rifting produce downwarping and the accumulation of large prisms of sediment. For example, the Lake Superior Basin contains almost 10 km (33,000 ft) of Proterozoic sediments associated with the MRS. But the SOA is different.

> The SOA does not seem to have accumulated a sedimentary record. This is a somewhat unusual rift zone where magmatism and tectonism were intimately interlinked as it seems to be nearly totally filled with igneous rocks. (Gilbert 2002 p. 33)

Why were there no sediments? Gilbert and McConnell (1991) suggest that there was initial crustal uplift with magmatism. But the absence of sediments also may indicate rapid magmatism. It is difficult to understand how crustal uplift would have prevented sedimentation. Local sedimentation would have contributed some fill over millions of years. After all, this was before the evolution of plants and normal weathering, erosion, and local transport would have been unimpeded by plants. All of the later sedimentary fill shows dramatic downwarping. Why would the rift have experienced uplift during the igneous fill phase and downwarp immediately after?

In addition to the absence of sediments, the SOA igneous fill indicates tectonism happening at the same time as the igneous activity. Attitude discordance exists between and among successively younger igneous units. If there was original horizontality of layering in igneous complexes, then the units were being tilted between flows. Finally, the local rugged relief on the top of the Carlton Rhyolite suggests rapid subsidence inside the SOA.

Reed (2000) interpreted the MRS as the extensional breakup of the northern midcontinent at the onset of the Genesis Flood. Is the SOA a southern example of a similar phenomenon in the southern midcontinent? Uniformitarians would be forced to disagree, since they place the two events over 600,000,000 years apart based on isotopic dating. But if the two are related, then the uniformitarian position becomes another argument for the inadequacy of isotopic dating. Although the plate tectonic bandwagon effect leads to most of the discussion of the SOA as one arm of a triple junction (Burke and Dewey, 1973), there are also difficulties with that interpretation.

The most striking difficulty is the lack of any similarity in composition or history between the Tobosa Basin, the SOA, and the Rome-Rough Creek-Mississippi Valley Graben. These were all supposedly connected at one time, and there should be some similarities; at least during the time that they were joined. As mentioned above, there is no evidence of rift valley sedimentation. There is no evidence of the numerous expected transform faults adjacent to the basins, nor is there any evidence of buried rift margin prism.

These problems led Viele and Thomas (1989) to propose a large transform fault across the Ouachita front of the southern United States. But their interpretation would predict a rifted margin prism in East Texas where none has been found. At least one researcher disagrees with the common tectonic interpretation of southern Oklahoma; McBee (1995, p. 46) stated, "It was probably not an aulacogen." He preferred the term, "Oklahoma Megashear" because he believed that the basin formed as a result of a large-scale left-lateral shearing in the crust (up to 55 km or 34 mi), related to continent-scale deformation caused by plate tectonic collisions. However, most other workers note that there is very little evidence for strike slip motions of this magnitude.

Conclusions

As geologists committed to biblical natural history continue the arduous task of reinterpreting the rock record within their framework, it becomes clear that it is seldom the physical evidence that demands the uniformitarian interpretations. Rather, the assumptions of deep time and evolution provide an overpowering filter that arranges data to fit these presuppositions. The basement in Oklahoma can be resolved within a young earth Flood history, and two features in particular argue against the uniformitarian position. The first is the absence of significant amounts of sedimentary rocks prior to the Cambrian transgression and the second is related: the statewide erosional discontinuity between the igneous basement and overlying sediments. Both would be predicted by the tremendous erosional power of the Genesis Flood.

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Notes from the Panorama of Science

Do Solar Sound Speeds Confirm the Standard Solar Model?

The standard solar model (SSM) views the sun as generating energy by fusion as it evolves to its presumed age of 4.6 billion years (Liebacher, 1985, p. 48; Bahcall et al., 1995, p. 784). There are actually many SSMs, but they vary relatively little in the choices of solar parameters (Bahcall, 1997, p. 1; Bahcall and Pinsonneault, 1997, p. 56). The modern SSM does not envision a static sun but a sun undergoing continuous change over its assumed evolutionary lifetime (Bahcall et al., 1995, p. 784). Though the presence of fusion in the sun would seem to be a neutral factor in relation to age, in the SSM the age of the sun is viewed as a crucial characteristic which determines whether the sun can be modelled accurately from a zero age on the main sequence into its present condition. Although the present day operation of the sun actually says nothing about its age, confirmation of the SSM is nevertheless typically seen as a validation of the evolutionary age of the sun—as well as other solar properties calculated by the model.

Helioseismology is the science of solar vibrations. By study of these vibrations the speed of sound in the sun can be inferred. It is claimed that sound speeds in the sun confirm the SSM (Liebacher, 1985, p. 54; Bahcall et al., 1997b, p. 171; Bahcall et al., 1997a, pp. L91, L93; Basu et al., 2000, p. 1098; Bahcall et al., 2001, p. 991). However, sound speeds in the sun are not observed. Only vibrations are observed. Sound speeds must be calculated ("inverted") from helioseismic data. Sound speed is a function of the density profile, the pressure gradient, and adiabatic indices, all of which are unknowns which must themselves be modelled for the solar interior (Basu et al., 2000, pp. 1085–1086). Therefore the inversion of sound speeds is performed using "reference models" which are actually SSMs (Basu et al., 2000, pp. 1084, 1086).

The success of a solar model in matching helioseismic data is computed by comparing model ("theoretical") sound speeds in the sun with solar sound speeds inferred from helioseismic oscillations (incorrectly thought of as "observed" sound speeds). But since the inversion of sound speeds from helioseismic oscillations requires the use of a reference solar model (really another SSM), model sound speeds have been compared with model sound speeds. If one takes the reference model as the standard, this procedure results in good agreement with other models also considered to be "standard solar models," but divergence results with models believed to be "non-standard." This is the basis of claims that "standard solar models are in remarkable agreement with helioseismological measurements of the Sun" (Basu et al., 2000, p. 1098). This is also why it is simultaneously true that, "No helioseismological constraints are used in defining the standard solar model" (Bahcall et al., 2001, p. 991), i.e., helioseismic sound speeds are "backed out" of the standard model rather than serving as input to constrain the predictions the model makes. In short, it cannot be said accurately that helioseismology confirms the SSM.

It is also claimed that the SSM disproves the possibility of significant mixing in the sun's interior (Bahcall et al., 1997b, p. 173). Based on the findings of helioseismology, it is postulated that diffusion is required there (Brun et al., 1998, pp. 913, 916), that mixing would make diffusion impossible (Bahcall et al., 1995, pp. 787, 804), and therefore that helioseismology rules out mixing models "with large amounts of interior mixing" (Bahcall et al., 1997b, p. 173). Further, it is claimed that non-standard models incorporating core mixing do not describe the sun as well as models including diffusion (Bahcall et al., 1997b, p. 173; Basu et al., 2000, p. 1093; Bahcall et al., 2001, p. 1002). This conclusion leads to the claim that a solar model should be considered a "standard model" only if it includes a diffusion mechanism (Bahcall and Pinsonneault, 1997, p. 61) and that models incorporating core mixing are "non-standard" (Bahcall and Ulmer, 1996, p. 4202).

Are these claims valid? Note that there are really only two essential claims in the preceding paragraph: (1) that helioseismology requires diffusion, which rules out the possibility of mixing; and (2) that solar models with mixing do not work as well as those without. Helioseismology has been applied to determine helium abundance in the solar photosphere. This helium is believed to be primordial (due to the assumed lack of large-scale mixing in the sun), and therefore the He abundance should be comparable to the abundance of He elsewhere in the solar system (Bahcall et al., 1995, p. 784). Helioseismology shows that photospheric He is "depleted" relative to the He level elsewhere in the solar system (Brun et al., 1998, p. 916). This depletion is taken to imply that diffusion operating over a time scale of the order of 10^{10} years must be slowly transporting helium from the solar surface into the interior. Since mixing would prevent this process, mixing is ruled out.

From the perspective of biblical creation, however, the solar system did not evolve from a common nebula, so there is no reason to expect that photospheric He abundance should be the same as He abundance elsewhere in the solar system. From the perspective of biblical creation, the He depletion problem is not a real problem and is therefore not a valid basis for assuming diffusion in the sun or for ruling out solar mixing.

With respect to the claim that mixing models do not work as well as models defined to be "standard," it must be remembered that models are verified by comparison with other models, as discussed above. Thus non-standard models such as those involving mixing come out looking worse in comparison with any standard reference model (Bahcall et al., 1997b, p. 173). Further, tests of mixing models have generally involved insertion of random and complete core mixing into an otherwise standard model, i.e., the mixing phenomenon is said to have been "artificially" added to the model (Basu et al., 2000, p. 1088). Since mixing would influence other model parameters, an "artificial" mixing model is not realistic, and compares poorly with other standard models.

There is in fact evidence that there may be significant mixing in the sun (Bahcall et al., 1995, p. 787). This mixing would be internal, since high rotation rates are ruled out based on evolutionary models of stellar operation which presume long age (Landini et al., 1986, pp. 217, 220; Rubenstein, 2001, p. 41). The older a star is, presumably the less its spin rate. Sun-like stars are supposed to be "middle aged" and no longer young. To the creationist who realizes that stars are not "old" but were created recently, however, such reasoning is seen to be irrelevant, and slow spin rates must be inferred in some other way.

There is another indicator also taken to imply that sun-like stars have low spin rates. "Rapidly rotating stars usually contain considerable lithium, a rather fragile element that is destroyed when it gets mixed into a hot stellar interior. Rapid rotation is thought to prevent such mixing. So by estimating the abundance of lithium, astronomers can gauge the rotation rate of a star" (Rubenstein, 2001, pp. 40–41). The sun is believed to be depleted in lithium by a factor of 150 or 160 compared with the expected value (Christensen-Dalsgaard et al., 1996, p. 1287; Bahcall et al., 1995, p. 787). The sun also has a low spin rate, apparently confirming the spin rate/lithium depletion relation.

Although this reasoning is widely accepted, it may not be accurate. This reasoning is a deduction from the presumed composition of the putative primordial solar nebula, but from a creationist standpoint, the solar system did not originate from a solar nebula, so the lithium depletion problem for the sun may not be real. Nonetheless, it is real to those who accept the solar nebula as the precursor of the solar system, and Christensen-Dalsgaard et al. (1996, p. 1287) propose that the solar lithium depletion problem in the sun could be resolved by a greater amount of mixing in the sun than is generally assumed.

How valid is this possibility? Data confirm that a relatively high degree of mixing may be occurring in the sun. The high angular momentum of the planets compared to the sun has been a long-standing problem for evolutionary models of solar system origins. It has become accepted that the sun, which allegedly possessed high angular momentum acquired from the solar nebula, has undergone a process of angular momentum transfer to the planets mediated by the solar magnetic field. This model of the sun's relatively low angular momentum leads to the expectation that the sun would now have a small internal rotation. Over 4.6 billion years "it is therefore believed that the sun has been losing angular momentum over its lifetime through its magnetized wind, thereby spinning down its outer convection zone and probably the bulk of its interior" (Thompson et al., 1996, p. 1300). Thus, the sun is believed to have a low spin rate due to the assumption of great age. Contrary to this expectation, helioseismic observations imply a relatively high spin rate in the solar interior (Claverie et al., 1981, p. 443; Isaak, 1982, p. 130). Such a conclusion imposes constraints on the alleged 4.6 billion year age of the sun, since evidently the sun has not had so much time to spin down. In a biblical creationist model, spin down over 4.6 billion years has not occurred, and there is indeed "rapidly rotating plasma deeper in the convection zone" than previously believed (Thompson et al., 1996, p. 1301). Interpreting such plasma motion as an artefact of spin down, GONG (Global Oscillation Network Group) researchers have acknowledged: "The spin down to the present state . . . may have involved material motion or instabilities, leading to mixing in the solar interior and thus affecting the structure of the . . . sun . . ." (Christensen-Dalsgaard et al., 1996, p. 1287). Though the core rotation rate is not certain (Thompson et al., 1996, p. 1301), it is thought that it may be "considerably faster than that of the solar surface" (Thompson et al., 1996, p. 1304) a conclusion echoing the earlier claim of Claverie et al. that the core rotation is "2–9 times [faster] than the observed surface rotation" (Claverie et al., 1981, p. 443).

Ironically, the SSM is thought to be firmly established despite the longstanding, unresolved angular momentum problem: "We conclude that the standard model . . . is robust in the light of the present acoustic-mode detection and that mixing in the core is not really favored, even though a proper understanding of the angular momentum evolution with time has not yet been reached" (Brun et al., 1998, p. 913). Such optimism about the SSM appears unjustified.

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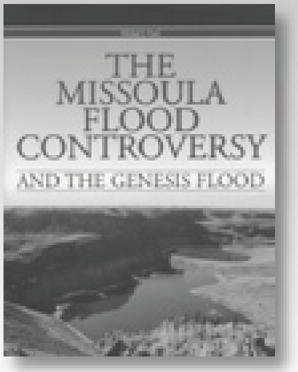

NEW!

The Missoula Flood Controversy and the Genesis Flood

by Michael J. Oard

CRS Books. 133 pages (8½ x 11 in.)

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One of the most spectacular floods in prehistoric times, besides the Genesis Flood, was the great Lake Missoula flood, which left its mark in the Channeled Scabland of the Pacific Northwest in the United States. However, the evidence was the subject of intense controversy for 40 years before being accepted. In this book, Michael Oard discusses not only the abundant evidence, which at the time was considered to be "too biblical," but also the circumstances surrounding the controversy.

A chapter is dedicated to other ice age floods, and evidence of the Genesis Flood is presented, consisting generally of new information from the field of geomorphology. Another chapter is devoted to a defense of the short time scale of Scripture.

Letters to the Editor

African Cattle Egret in the New World: Stormy Arrival

After reading Carl Froede's recent article, "Dust Storms from the Sub-Saharan African Continent: Implications for Plant and Insect Dispersion in the Post-Flood World," (Froede, 2003), I could not help but be reminded of other life-forms which have taken a similar route across the Atlantic Ocean–for instance, the common African cattle egret *(Bubulcus ibis)*. Originally an Old World animal, several cattle egrets (or cowbirds) first appeared in Suriname, South America, in the late 1870s, apparently blown off course across the Atlantic by a hurricane or other storm. They then migrated to the Caribbean and were in Florida by the 1930s and 1940s. Today they are widespread across the United States. Though cattle egrets represent a recent arrival via Africa, it might be advantageous for creation biologists to pursue research on the first arrivals of many "New World" species of birds (and other animals). The wildlife dispersal from the mountains of Ararat after the Flood took many shapes and forms, and some of the clues to the original migration routes could still be out there by investigating the animal populations in various continents.

Along similar lines, the plant and animal repopulation of the Indonesian island of Krakatoa after its catastrophic volcanic explosion in 1993 is another wonderful laboratory for seeing how plants, insects, and other animals found their way to a new home in a formerly inhospitable environment. This definitely has relevance to creation biologists seeking to understand the methods of dispersal of animal (and plant) life after the Flood.

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Science and Scripture

The December 2003 issue of the *CRSQ* contained a letter to the editor by Andrew Repp regarding my letter published in the June 2003 *CRSQ*. I hope that his letter will cause people to go back and reread my letter. If they do, I believe they will then see that Repp has missed the point. If nothing else I hope that readers will take the trouble to look up the Bible passages that he believes "present five biblical reasons we are in fact obligated to explain how 'specific places in particular came to have the rock strata they have.'" I respectfully submit that these passages do not support his argument. For instance, "seek out" (KJV) does not necessarily imply "explain how." It could just as well be interpreted to mean, "look for evidence of God's creative power, evidence of design."

Repp does not understand what Reed and Woodmorappe (*CRSQ* 39:55–57 and Aufdemberge, 2003, pp. 57–58) mean by the expression, "warped exegetical interpretation." This is what I mean by using their expression. It means interpreting scripture in a way that backs up your argument. One way this is done is to take the passage out of context. For example, Repp quotes the last half of Proverbs 25:2, "the honor of kings is to search out a matter."(KJV) "A matter" in the context of Repp's letter is "any investigation of natural history." The entire Proverbs 25:2 passage reads, "It is the glory of God to conceal a matter; to search out a matter is the glory of kings." (NIV) It seems to me God is saying that searching out a matter gives glory to kings (human beings) not God. I believe this passage backs supports one of my contentions, that model building, trying to explain how God created something, gives, in the eyes of the world, glory to the creator of the model not to God no matter what is the intent of the model builder. Proverbs says, "It is God's glory to hide the matter." I believe He did this in at least two ways; by not telling us in the Bible how the rocks of a particular place came to be that way and by creating time to point only forward. Thus we can not go back and observe prehistoric events to see how things came to be the way they are. If it is to God's glory to conceal this, I believe it is unproductive for Bible believing scientists to try to search out the matter. Mr. Repp and others may disagree with me, but I do not believe my position is as deeply flawed as his biblical interpretation. In my opinion, the other four passages are also misapplications of the Scripture passages cited. I will let the readers come to their own conclusions.

I agree with Repp when he demands that models be tested. However tested to me means something different than asking is it possible. Those who believe the canopy theory will answer, "Yes, it is possible," and those opposed to the canopy theory will say "It is not possible." Those who believe that a single catastrophe produced the observed fossils and rock layers will say "Yes, it is possible," others will say "No, it is not." I believe models or explanations of past events cannot be tested scientifically. The best one can do is to ask if the explanation is probable given what we know about nature and its God created laws. Thus the job of the scientist who is a young earth creationist is to study nature and its processes to discover things which make uniformitarian models less probable. In my opinion the job of the *CRSQ* is to publish papers about nature that make the theory of evolution less probable in the eyes of general public and hopefully in the eyes of the scientific establishment.

Mr. Repp claims that it does no good to identify the weakness of the evolutionary theories without providing an alternative theory. I disagree. In my opinion, quoting a fraction of Ecclesiastes chapter 3 to justify model building is another example of warped exegesis.

If people believe that, "it is not enough to break down evolutionary models; rather, biblically sound models must be built in their place," they can try to do so. However, I am convinced this is not humanly possible. I believe the modelers who claim to have invented biblically sound models should consider whether or not the words of Jeremiah 23:31–32 apply to them. "Yes, declares the LORD, I am against the prophets who wag their own tongues and yet declare, The LORD declares. Indeed, I am against those who prophesy false dreams, declares the LORD. They tell them and lead my people astray with their reckless lies, yet I did not send or appoint them. They do not benefit these people in the least, declares the LORD."

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A Misrepresentation by Jim Foley: A Correction

Introduction

The claim that "misquoting" by creationists is universal (or close to it) was investigated, and a specific example was examined. The claims of Jim Foley (he goes by Jim, not James) in the case evaluated are shown to be erroneous. Jim Foley is an active opposer of all forms of creationism. As of October, 2001, he has put 357 files (4,750,000 bytes) on his web site "fossil Hominids FAQ at talk.origins Archive." On his website he frequently calls creationists names such as "stupid" and claims that to argue with a creationist one "might as well argue with a squid" (2004, p. 2). He admits his qualifications to write on human evolution are "in a word: none," except a lot of reading (p. 2). I tried to find out about his educational and occupational background, but have been unable to verify information in this area. The indications are that he works in the computer industry. I do not know why he goes by "Jim" instead of "James Foley." He concludes "creationism is dreadful science" and as a result of "a campaign to evangelize fundamentalist religion" creationists are "running scared from the evidence" (2004, p. 1).

Below is reprinted Foley's entire critique of my article published in *CRSQ*:

> **Creationists' Arguments: Misquotes**
> This file contains some of the more blatant instances in which creationists have misquoted their sources when writing about human evolution. In all cases where the text has been made bold the emphasis has been added by me.
>
> Jerry Bergman, in an article about *Nebraska Man* (The History of *Hesperopithecus haroldcookii Hominoidea*, Creation Science Research Quarterly [sic], 30:27–34, 1993) makes the following statement:
>
> > Nebraska Man also had a great patriotic significance because it was the first evidence according to Osborn, after seventy-five years of continuous search in all parts of our great Western territory of a [higher] primate. Evidence of this anthropoid **ape-man** was also **proof** that some primitive humans lived in America, and some speculated that it may even prove that mankind in North America predated European and African humans. We have all eagerly looked forward to such a discovery (quoted in Blinderman, 1985, p. 48)
>
> However, the quoted paper (Blinderman, 1985: The curious case of Nebraska Man. *Science* 85, June:47–9) makes no such statement! Blinderman said: So Nebraska Man had great patriotic significance. "This is the very first evidence," Osborn wrote, "after seventy-five years of continuous search in all parts of our great western territory, of a [higher] Primate. ...we have all eagerly looked forward to such a discovery ...." (ellipses by Blinderman).
>
> The references to "ape-man" and "proof" were added, either by Bergman or by a source which he copied from. In fact, although Osborn did misidentify the Nebraska Man tooth as a primate, he deliberately did not make any claims to its status as an ape-man (Foley, 2003).

My response: My "[sic]" above calls attention to the fact that Foley made an error in the journal's name ("*Creation Science Research Society Quarterly*") in which my Nebraska Man article appeared. The correct name is "*Creation Research Society Quarterly*." This demonstrates that one who accused others of misprints is not without fault and also can make errors!

The examples used by Foley are claimed to be "the more blatant instances" of "Creationist ... Misquotes." Presumably the worst example (my article) was listed first. Therefore, an examination of this example will shed some light on Foley's practices. What happened was that two pairs of quotation marks were left out and the section was indented incorrectly. Here is the Blinderman quotation as it appeared in my paper. The bold faced words are a direct quotation from Osborne, as reported by Blinderman. Note that the indenting to indicate the quotation was incorrect:

> **after seventy-five years of continuous search in all parts of our great Western territory of a [higher] primate**. Evidence of this anthropoid ape-man was also proof that some primitive humans lived in America, and some speculated that it may even prove that mankind in North America predated European and African humans. **We have all eagerly looked forward to such a discovery** (quoted in Blinderman, 1985, p. 48). (Bergman, 1993, p. 28).

The sentence in the middle of the quotation was my own and should not have been part of the indented section. The section should have been set out as follows:

> "after seventy-five years of continuous search in all parts of our great Western territory of a [higher] primate." Evidence of this anthropoid ape-man was also proof that some primitive humans lived in America, and some speculated that it may even prove that mankind in North America predated European and African humans. "We have all eagerly looked forward to such a discovery" (quoted in Blinderman, 1985, p. 48).

Foley (2003) implied that I had "added" material to the words of Osborn. Although my minor error did attribute one sentence of my own to Osborn, that was not my intent and I reject Foley's implication that it was done in order to "deceive" the reader into incorrectly thinking that Osborn saw Nebraska Man as an "ape-man." To conclude from this minor mistake that my usage of the quotation is an attempt to deceive requires knowledge of intent, something for which no basis of fact exists (and for which Foley assumed the worst). Note that Blinderman's article *did* contain the terms "ape-man" and "proof," words Foley wrongly claimed that Osborn never used to describe Nebraska Man.

Are Foley's Charges Correct?

A typographical error (which is all that has been shown to have occurred in this case) is quite different from my trying to mislead readers as Jim Foley has claimed. The quotation adds nothing to the paper, and the charge against me is not only inaccurate, but somewhat slanderous. The major concern is whether Foley's remark (that Osborn did "not make any claims" that Nebraska Man was "an ape-man" but only a "primate") is accurate. In fact, Osborn referred to "Nebraska Man" as much *more* than an "ape-man," specifically as a man-ape (stressing its human traits). Osborn said in print that this "discovery" of Nebraska Man was "proof that some primitive humans lived in America" in numerous places.

One example is from *The Forum* (Vol. 73, June 1925, pp. 800–801) where Osborn said that Hesperopithecus was "irrefutable evidence that the man-apes wandered over from Asia into North America." Osborn added that this "little tooth speaks volumes of truth" in support of this conclusion. I located other quotes that said the same thing (see Osborn, 1925a, pp. 42–43, where he said the tooth "speaks to the presence of the higher or manlike apes in our Western country" (emphasis in both cases mine). Foley obviously is not familiar with Osborn's writings; he not only misrepresented me, but also Osborn.

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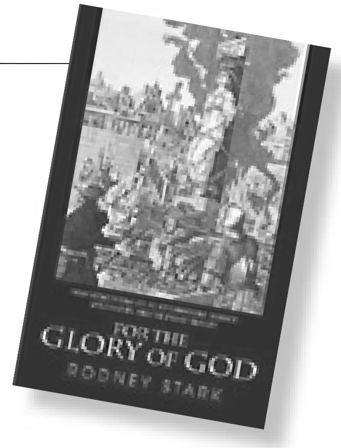
Book Review

For the Glory of God **by Rodney Stark**
Princeton University Press, 2003, Princeton, NJ, 200 pages, $20



I imagine that most scientists share my first reactions to sociologists writing about science—grated teeth, tense muscles, elevated blood pressure, and a compelling desire for a refund. But an exception to the rule can be found in Stark's *For the Glory of God*, subtitled, *How Monotheism led to Reformations, Science, Witch-Hunts, and the end of Slavery*. The second chapter, "God's Handiwork: the Religious Origins of Science," makes the book well worth the attention of any *CRSQ* reader. Although Professor Stark pointedly states early on that his religious beliefs are his own business, he treats the beliefs of others with a professional seriousness and respect seldom found in academia. This book stands as another marker on a path of scholarly discovery that has crept out of the 20th Century, a path that leads to the knowledge that Christianity was indispensable to the formulation of science as we enjoy it today.

In debunking the professional debunkers from Voltaire to Richard Dawkins, Stark punctures almost every balloon of the modern mythology of religious history that has been foisted on an unsuspecting public for more decades than should have been allowed. The Dark Ages was a period of technological innovation that shamed the Greeks and Romans. The Renaissance included a bunch of pedantic elite linguists who had little to do with the scientific revolution. The "Scientific Revolution" was an ongoing series of discoveries closely tied to the university system that started in the 13th Century. The Church vs. Science? Who do you think started, enriched, encouraged, and protected the universities? Science and Islam? Science and China? Both lacked the theology to advance beyond alchemy. And what about all those religious "flat Earthers"? They were all busy trying to tell Columbus the true circumference of the globe. And on it goes as myth after modern myth is corrected.

Stark treats Darwinian evolution as an aberration in the history of science, noting that the conflict between science and religion presented by the Enlightenment intelligentsia was actually a crusade against religion by those who wished to be rid of it. Thus he states, "When Julian Huxley claimed that 'Darwin's theory is no longer a theory, but a fact,' he surely knew better. But just like his grandfather, Thomas Henry Huxley, he knew that his lie served the greater good of 'enlightenment'" (p. 185). This method of leaving the truth in the dust in service of emancipation from religion has a long lineage. Stark notes the popular story of Thomas Huxley's confrontation with Bishop Wilberforce, and remarks, "Trouble is, it didn't happen" (p. 188). As a sociologist, Stark declines to enter the subject he is discussing and does not provide any concrete views of his own about evolution, although my subjective reading between the lines finds evidence of sympathy for the views of the Intelligent Design proponents.

As more and more people understand the irremediable religious roots of the argument about origins and Earth history, their perspective changes, and many of the "truths" that we learned (and that are unfortunately still being taught) can be seen for the propaganda that they are. Stark has done a great service in demythologizing secular versions of the past and his insights are worth the time and effort of any informed person. Stark states "It is, of course, easy to find fault. Sad to say, in today's intellectual climate, it takes much greater courage to praise. I hope that I measured up." You did, Dr. Stark. Purchase, peruse, ponder!

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Minutes of the 2004 Creation Research Society Board of Directors Meeting

On Thursday, 3 June 2004 a meeting of the Board of Directors (BOD) was held at the Embassy Suites Airport West, Phoenix, Arizona, from 1900 hours to 2000 hours to plan for the committee meetings on Friday. On Friday, 4 June 2004 between the hours of 1230 and 1630 at the Van Andel Creation Research Center (VACRC) the Publication, Membership, Quarterly, Internet, Research, and Constitution/Bylaws/Advanced Planning Committees each met separately for approximately one hour to plan for the Saturday business meeting.

On Saturday, 5 June 2004 the closed business meeting of the BOD was called to order at 0830 hours, Present: K. Anderson, T. Aufdemberge, E. Chaffin, D. DeYoung, W. Frair, H. Giesecke, R. Humphreys, G. Howe, D. Kaufmann, G. Locklair, R. Samec, G. Wolfrom. Absent: M. Oard, J. Reed.

The minutes of the 2003 BOD meeting were accepted with an amendment deleting the word "memberships "from the following statement: "The membership committee report by Kaufmann resulted in the following actions: it was passed to set up an Ad Hoc Outreach Committee of (Oard, Chair, Giesecke, DeYoung) to devise a plan to centralize the receipt and processing of funds for memberships, donations, and sales of publications at our facilities at Chino Valley, Arizona."

Recording Secretary Kaufmann reported that the following were elected to a three year term to the BOD: D. DeYoung, R. Humphreys, D. Kaufmann, G. Locklair and R. Samec.

The Treasurer's report by Locklair was presented and accepted with a balanced budget of $330,000.

The finance committee report by Aufdemberge stated that our investments totaled $531,753 with an annual income of $25,448.

The membership report by Wolfrom was given as follows: total membership for 2003/04 was 1710 (674 voting, 715 sustaining, 310 subscriber and 11 students). This is an increase of 16 from the 2002/03 membership year.

The membership committee report by Kaufmann resulted in the following actions. It was passed to increase by three dollars the fees for memberships and subscriptions for the *CRSQ* in all categories with the exception of life and patron. It was passed to co-host with Answers in Genesis (AIG) the creation conference to be held at Liberty University, Lynchburg, VA, July 18–22, 2005, with a special conference rate for joining CRS. It was passed pending AIG approval to host a hospitality hour at the creation conference on registration day. It was passed to have the ad hoc outreach committee develop and present outreach options

above: Informal discussions among board members are an important part of the Annual Meeting. Left to right: Michael Oard, Gene Chaffin, Ron Samec, and Russ Humphreys.

left: Much of the agenda for the combined board meeting is set by the committees. Pictured here are those committee members and guests who attended the meeting of the Internet Committee (left to right): Hank Giesecke, Russ Humphreys, Gary Locklair (chairman), Glen Wolfrom, and Ron Samec.

via email to the membership committee for consideration at our next BOD meeting.

Chaffin reported for the research committee that nine principal investigators, some who have more than one project, are currently active in research supported from the research fund.

The lab committee report by DeYoung explained the staff and facilities functions at VACRC. He reported that John Meyer has been given the title Resident Scientist at VACRC. It was passed to consolidate bookkeeping functions between VACRC and CRS making VACRC a line item under the CRS organizational structure.

The internet committee report by Locklair noted that we receive more than 500,000 visits to our web page each month. It was passed to allow the Treasurer up to $500 to purchase the rights to the www.crs.com domain. It was passed to send a gift of $250 to our Webmaster, Fred Williams, for his services. It was passed to have a budget of $2000 for internet costs for the coming year.

The constitution committee report by Kaufmann resulted in the following actions. It was passed to redefine the Treasurer's position according to the attached description. It was passed to have the Assistant VACRC Director submit a job description of his functions to the 2005 BOD meeting for approval.

The RATE committee report by Humphreys announced that the RATE projects will be terminated in 2005 with the publication of a technical book and a popular book.

The quarterly committee report by Howe resulted in the following actions. Kevin Anderson will continue as *CRSQ* Editor with all other editors remaining with addition of Ron Samec as astronomy editor. It was passed that former board member Lane Lester be hired to serve as Managing Editor of the *CRSQ* receiving pay of $15 per hour. His time is not to exceed a total 160 hours on the four issues of September 2004, December 2004, March 2005 and June 2005 unless otherwise authorized by the executive council. He will be responsible to the Editor, Kevin Anderson.

The Creation Matters (CM) report by Wolfrom stated that CM began in 1996 and is currently publishing Volume 9. Each issue is published bimonthly with eight to 12 pages.

The publications committee report by Howe resulted in the following actions. It was passed that all book orders will be directed to the lab and that this procedural revision be noted in the *CRSQ*, CM, and the Catalogue. It was passed that the BOD empower Mike Oard and the VACRC staff to devise sales and other means of judiciously disposing of all but ten of the back issues for the first 20 years of *CRSQ*. It was passed to purchase advertising each year in the Buyer's Guide to Scientific, Medical and Scholarly Journals.

It was passed to accept the resignations of R. Gentet, L. Lester and E. Williams, all who left the board for personal reasons.

It was passed to honor Dr. Emmett Williams for his many years of service on the BOD in such capacities as originator of CRS Books, Editor of the *CRSQ* for three terms, Managing Editor for two terms and President for one term. Thanks, Emmett.

It was passed to nominate the following persons for the BOD election in 2005: M. Armitage, T. Aufdemberge, G. Howe, M. Oard and D. Rodabaugh.

The following officers were elected for the 2004/2005: President, D. DeYoung; Vice President, E. Chaffin; Recording Secretary, D. Kaufmann; Treasurer, G. Locklair; Membership Secretary, G. Wolfrom; Financial Secretary, T. Aufdemberge.

It was passed to hold the 2005 BOD meeting at Bozeman, Montana , June 2 to 4, 2005.

The meeting was adjourned at 1530 hours.

Respectfully submitted,
David A. Kaufmann, Recording Secretary

POSITION: Treasurer

LENGTH OF TERM: Three years – elected annually at a Board meeting and reconfirmed annually by the Board

RESPONSIBILITIES AND DUTIES:

a) at the annual meetings
  - Report to the Board on the finances of the Society
  - Advise the Board on the financial implication of Board actions

b) between annual meetings supervise and oversee the following financial activities of the VACRC office staff:
  - Pay Board member expenses
  - Receive and deposit general Society funds
  - Keep bank account and other records for Society funds
  - Maintain appropriate ledgers for income and expense
  - Pay bills and invoices against the Society
  - Secure financial review of all operations by a competent accountant or CPA

AUTHORITY:

- Co-signer for legal documents

SPECIAL QUALIFICATIONS OR EXPERIENCE:

- Ability and experience in handling and keeping financial records and transactions
- Faithful stewardship in handling monies and receipt

Instructions to Authors

Submission

Submit an original plus two copies of each manuscript to the editor of the *Creation Research Society Quarterly* (see the inside front cover for address). Concurrent submission of an electronic version (Word, WordPerfect, or Rich Text Format) of the manuscript text and graphics is also encouraged. The manuscript and graphics will not be returned to authors unless a stamped, self-addressed envelope accompanies submission. Manuscripts containing more than 30 pages are discouraged. An author who determines that the topic cannot be adequately covered within this number of pages is encouraged to submit separate papers that can be serialized.

All submitted manuscripts will be reviewed by two or more technical referees. However, each section editor of the *Quarterly* has final authority regarding the acceptance of a manuscript for publication. While some manuscripts may be accepted with little or no modification, typically editors will seek specific revisions of the manuscript before acceptance. Authors will then be asked to submit revisions based upon comments made by the referees. In these instances, authors are encouraged to submit a detailed letter explaining changes made in the revision, and, if necessary, give reasons for not incorporating specific changes suggested by the editor or reviewer. If an author believes the rejection of a manuscript was not justified, an appeal may be made to the *Quarterly* editor (details of appeal process at the Society's web site, www.creationresearch.org).

Authors who are unsure of proper English usage should have their manuscripts checked by someone proficient in the English language. Also, authors should endeavor to make certain the manuscript (particularly the references) conforms to the style and format of the *Quarterly*. Manuscripts may be rejected on the basis of poor English or lack of conformity to the proper format.

The *Quarterly* is a journal of original writings, and only under unusual circumstances will previously published material be reprinted. Questions regarding this should be submitted to the Editor (*CRSQ* editor@creationresearch.org) prior to submitting any previously published material. In addition, manuscripts submitted to the *Quarterly* should not be concurrently submitted to another journal. Violation of this will result in immediate rejection of the submitted manuscript. Also, if an author uses copyrighted photographs or other material, a release from the copyright holder should be submitted.

Appearance

Manuscripts shall be computer-printed or neatly typed. Lines should be double-spaced, including figure legends, table footnotes, and references. All pages should be sequentially numbered. Upon acceptance of the manuscript for publication, an electronic version is requested (Word, WordPerfect, or Rich Text Format), with the graphics in separate electronic files. However, if submission of an electronic final version is not possible for the author, then a cleanly printed or typed copy is acceptable.

Submitted manuscripts should have the following organizational format:

1. Title page. This page should contain the title of the manuscript, the author's name, and all relevant contact information (including mailing address, telephone number, fax number, and e-mail address). If the manuscript is submitted by multiple authors, one author should serve as the corresponding author, and this should be noted on the title page.

2. Abstract page. This is page 1 of the manuscript, and should contain the article title at the top, followed by the abstract for the article. Abstracts should be between 75 and 200 words in length and present an overview of the material discussed in the article, including all major conclusions. Use of abbreviations and references in the abstract should be avoided. This page should also contain at least five key words appropriate for identifying this article via a computer search.

3. Introduction. The introduction should provide sufficient background information to allow the reader to understand the relevance and significance of the article for creation science.

4. Body of the text. Two types of headings are typically used by the *CRSQ*. A major heading consists of a large font bold print that is centered in column, and is used for each major change of focus or topic. A minor heading consists of a regular font bold print that is flush to the left margin, and is used following a major heading and helps to organize points within each major topic. Do not split words with hyphens, or use all capital letters for any words. Also, do not use bold type, except for headings (italics can be occasionally used to draw distinction to specific words). Italics should not be used for foreign words in common usage, e.g., "et al.", "ibid.", "ca." and "ad infinitum." Previously published literature should be cited using the author's last name(s) and the year of publication (ex. Smith, 2003; Smith and Jones, 2003). If the citation has more than two authors, only the first author's name should appear (ex. Smith et al., 2003). Contributing authors should examine this issue of the *CRSQ* or consult the society's web site for specific examples as well as a more detailed explanation of manuscript preparation. Frequently used terms can be abbreviated by placing abbreviations in parentheses following the first usage of the term in the text, for example, polyacrylamide electrophoresis (PAGE) or catastrophic plate tectonics (CPT). Only the abbreviation need be used afterward. If numerous abbreviations are used, authors should consider providing a list of abbreviations. Also, because of the variable usage of the terms "microevolution" and "macroevolution," authors should clearly define how they are specifically using these terms. Use of the term "creationism" should be avoided. All figures and tables should be cited in the body of the text, and be numbered in the sequential order that they appear in the text (figures and tables are numbered separately with Arabic and Roman numerals, respectively).

5. Summary. A summary paragraph(s) is often useful for readers. The summary should provide the reader an overview of the material just presented, and often helps the reader to summarize the salient points and conclusions the author has made throughout the text.

6. References. Authors should take extra measures to be certain that all references cited within the text are documented in the reference section. These references should be formatted in the current *CRSQ* style. (When the *Quarterly* appears in the references multiple times, then an abbreviation to *CRSQ* is acceptable.) The examples below cover the most common types of references:

Robinson, D.A., and D.P. Cavanaugh. 1998. A quantitative approach to baraminology with examples from the catarrhine primates. *CRSQ* 34:196–208.

Lipman, E.A., B. Schuler, O. Bakajin, and W.A. Eaton. 2003. Single-molecule measurement of protein folding kinetics. *Science* 301:1233–1235.

Margulis, L. 1971a. The origin of plant and animal cells. *American Scientific* 59:230–235.

———. 1971b. *Origin of Eukaryotic Cells*. Yale University Press, New Haven, CT.

Hitchcock, A.S. 1971. *Manual of Grasses of the United States*. Dover Publications, New York.

Walker, T.B. 1994. A biblical geologic model. In Walsh, R.E. (editor), *Proceedings of the Third International Conference on Creationism* (technical symposium sessions), pp. 581–592. Creation Science Fellowship, Pittsburgh, PA.

7. Tables. All tables cited in the text should be individually placed in numerical order following the reference section, and not embedded in the text. Each table should have a header statement that serves as a title for that table (see a current issue of the *Quarterly* for specific examples). Use tabs, rather than multiple spaces, in aligning columns within a table. Tables should be composed with *14-point type* to insure proper appearance in the columns of the *CRSQ*.

8. Figures. All figures cited in the text should be individually placed in numerical order, and placed after the tables. Do not embed figures in the text. Each figure should contain a legend that provides sufficient description to enable the reader to understand the basic concepts of the figure without needing to refer to the text. Legends should be on a separate page from the figure. All figures and drawings should be of high quality (hand-drawn illustrations and lettering should be professionally done). Patterns, not shading, should be used to distinguish areas within graphs or other figures. Unacceptable illustrations will result in rejection of the manuscript. Authors are also strongly encouraged to submit an electronic version (.cdr, .cpt, .gif, .jpg, and .tif formats) of all figures in individual files that are separate from the electronic file containing the text and tables.

Special Sections

Letters to the Editor:

Submission of letters regarding topics relevant to the society or creation science is encouraged. Submission of letters commenting upon articles published in the *Quarterly* will be published two issues after the article's original publication date. Authors will be given an opportunity for a concurrent response. No further letters referring to a specific *Quarterly* article will be published. Following this period, individuals who desire to write additional responses/comments (particularly critical comments) regarding a specific *Quarterly* article are encouraged to submit their own articles to the *Quarterly* for review and publication.

Editor's Forum:

Occasionally, the editor will invite individuals to submit differing opinions on specific topics relevant to the *Quarterly*. Each author will have opportunity to present a position paper (1000 words), and one response (500 words) to the differing position paper. In all matters, the editor will have final and complete editorial control. Topics for these forums will be solely at the editor's discretion, but suggestions of topics are welcome.

Book Reviews:

All book reviews should be submitted to the book review editor, who will determine the acceptability of each submitted review. Book reviews should be limited to 1000 words. Following the style of reviews printed in this issue, all book reviews should contain the following information: book title, author, publisher, publication date, number of pages, and retail cost. Reviews should endeavor to present the salient points of the book that are relevant to the issues of creation/evolution. Typically, such points are accompanied by the reviewer's analysis of the book's content, clarity, and relevance to the creation issue.

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3. **Student Member** ....Those who are enrolled full time in high school or undergraduate college.
4. **Senior Member** ....Voting or sustaining members who are age 65 or older.
5. **Life Member** ....A special category for voting and sustaining members entitling them to a lifetime membership to the Society.
6. **Patron Member** ....A special category for voting and sustaining members who either make a one-time $2,500 contribution to the Society's general fund, or contribute $500/year for five years. A Patron Member receives a life-time subscription, a plaque, and has his or her name listed in the Quarterly each year.
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Creation Research Society

History—The Creation Research Society was organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a need for an association devoted to research and publication in the field of scientific creation, with a current membership of over 600 voting members (graduate degrees in science) and about 1000 non-voting members. The Creation Research Society Quarterly has been gradually enlarged and improved and now is recognized as the outstanding publication in the field. In 1996 the *CRSQ* was joined by the newsletter Creation Matters as a source of information of interest to creationists.

Activities—The society is a research and publication society. The society is a research and publication society, and also engages in various meetings and promotional activities. There is no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund is maintained to assist in such projects. Contributions to the research fund for these purposes are tax deductible. As part of its vigorous research and field study programs, the Society operates The Van Andel Creation Research Center in Chino Valley, Arizona.

Membership—Voting membership is limited to scientists who have at least an earned graduate degree in a natural or applied science and subscribe to the Statement of Belief. Sustaining membership is available for those who do not meet the academic criterion for voting membership, but do subscribe to the Statement of Belief.

Statement of Belief—Members of the Creation Research Society, which include research scientists representing various fields of scientific inquiry, are committed to full belief in the Biblical record of creation and early history, and thus to a concept of dynamic special creation (as opposed to evolution) both of the universe and the earth with its complexity of living forms. We propose to re-evaluate science from this viewpoint, and since 1964 have published a quarterly of research articles in this field. All members of the Society subscribe to the following statement of belief:

1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and scientifically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.
2. All basic types of living things, including humans, were made by direct creative acts of God during the Creation Week described in Genesis. Whatever biological changes have occurred since Creation Week have accomplished only changes within the original created kinds.
3. The Great Flood described in Genesis, commonly referred to as the Noachian Flood, was a historical event worldwide in its extent and effect.
4. We are an organization of Christian men and women of science who accept Jesus Christ as our Lord and Savior. The act of the special creation of Adam and Eve as one man and woman and their subsequent fall into sin is the basis for our belief in the necessity of a Savior for all people. Therefore, salvation can come only through accepting Jesus Christ as our Savior.

CREATION RESEARCH SOCIETY
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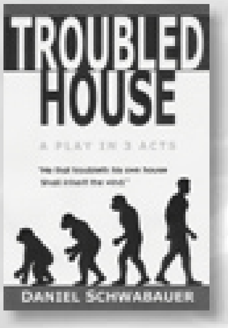
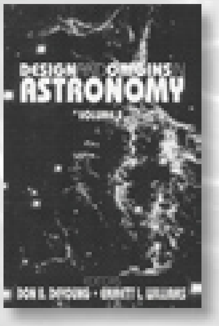


Troubled House: A Play in 3 Acts

Daniel Schwabauer. 2003. National Book Network, 132 pages. $10.00.

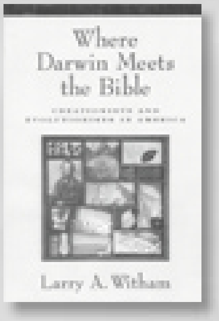
This exciting and thought-challenging drama focuses on events centered at a university where an agnostic biology professor is accused of teaching creation. As an upside-down version of "Inherit the Wind," it exposes the tyranny of thought control in science.


DESIGN AND ORIGINS IN ASTRONOMY
VOLUME 2
DON B. DeYOUNG · EMMETT L. WILLIAMS

Design and Origins in Astronomy, Volume 2

Don B. DeYoung and Emmett L. Williams (editors). 2002. Creation Research Society, 163 pages. $11.00.

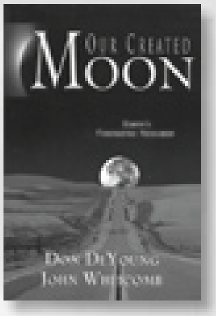
This is number 12 in the monograph series and the second volume on astronomy that is a compilation of articles from the *Creation Research Society Quarterly*. Topics include the age of the sun, impact craters in Arizona and on the moon, planets and magnetism, speed-of-light studies, stellar evolution, the destiny of comets, and mysterious dark matter.


Where Darwin Meets the Bible
CREATIONISTS AND EVOLUTIONISTS IN AMERICA
Larry A. Witham

Where Darwin Meets the Bible: Creationists and Evolutionists in America

Larry A.Witham. 2002. Oxford University Press, 330 pages. $25.00 (hard cover).

Author Witham, a reporter for *The Washington Times*, objectively discusses the creation-evolution controversy. The book is comprehensive, and is very important for helping creationists and evolutionists understand the pertinent issues.



Our Created Moon—Earth's Fascinating Neighbor

Don DeYoung and John Whitcomb. 2003. Master Books, 144 pages. $11.00.

Using a question- and answer-style, the authors present a simplified and updated version of their 1978 book on the moon. Sections include the characteristics, origin hypotheses, and purposes of the moon. Answers to critics make up the last section.

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